West Valley Demonstration Project

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REMOTE HANDLED WASTE FACILITY
OVERALL PLANT DESIGN DESCRIPTION

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WEST VALLEY NUCLEAR SERVICES CO., INC.

Contract Number 19-094708-C-CA

Remote Handled Waste Facility

OVERALL PLANT DESIGN DESCRIPTION

REVISION: 7 (General Revision to Comply with Asbuilt Conditions)
DATE : April 26, 2004

The Butler Team

Butler Construction Company
Washington Group International Incorporated (formerly Raytheon Nuclear Incorporated)
Quality Inspection Services
Quackenbush Company Incorporated
Ferguson Electric Construction Company, Incorporated

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OVERALL PLANT DESIGN DESCRIPTION

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1. INTRODUCTION

The West Valley Demonstration Project (WVDP) is conducting waste management and environmental restoration of a former nuclear fuel reprocessing facility in West Valley, New York. In support of clean-up activities at the WVDP, solid waste that is contaminated with beta-gamma and/or alpha emitting nuclides must be characterized and packaged for final disposition. A Remote Handled Waste Facility (RHWF) will be constructed for receiving, characterizing, processing, and repackaging various contaminated waste items for shipment off-site to a disposal facility, or for interim storage pending shipment offsite for disposition.

The RHWF will receive high activity solid waste from various other locations on the WVDP Site. The solid waste containers will be moved into a Work Cell for processing. Each waste container will be opened and the waste items removed, sorted, and segmented, as required, for repackaging. The waste processing will be by remote handled (RH) operations using equipment controlled by operators behind shield windows and shield walls. The final waste disposal containers will be loaded remotely and removed for shipment offsite or to interim storage on-site.

This Overall Plant Design Description (OPDD) provides the facility design and operation description. Detailed discussions of the facility, its layout, the included systems and equipment, and the significant features are provided within this OPDD. Each system is described in more detail in individual System Design Descriptions (SDD's). The following is a listing of the individual SDDs:

R01	Remote Processing System
R02	Waste Packaging System
R03	Shielding System
R04	Radiation Protection System
R05	Radiation Monitoring System
R06	Waste Collection & Transfer System
R07	Decontamination System
R08	HVAC Systems
R09	Civil/Structural
R10	Electrical Distribution System
R11	Compressed Air Supply System
R12	Demineralized Water Distribution System
R13	Fire Protection System
R14	Controls & Instrumentation System
R15	Security
R16	Communications

2. PURPOSES OF DOCUMENT

The purposes of the OPDD include the following:

- Provide an overall design description of the Remote Handled Waste Facility.
- Provide the facility description and the relationships of the general arrangements of the facility.
- Provide an upper level description of the systems and provide a roadmap to the detailed system descriptions.
- Provide a roadmap (Matrix of criteria versus SDD or other design document establishing a design, which implements the design criteria) on how design criteria were included in the preliminary design, final design, construction, start-up and operation.
- Provide an overall plant analysis based upon upper tier documents to establish safety and quality classification of systems, structures, and components (Appendices A)
- Provide overall design checklists, which were used to help insure that the desired features are included in the design (Appendix B).
- Provide a matrix indicating documents where each criteria is met (Appendix C)
- Provide overall guidelines for industry codes, which were utilized for design and construction.

3. OVERALL FACILITY DESCRIPTION

3.1 Introduction

The Remote Handled Waste Facility (RHWF) is designed with shielding for the operators and with remote handling equipment for waste characterization and repackaging. Three zones of confinement between areas containing high levels of radioactive contamination and the environment are provided to allow waste streams with the highest potential for generating airborne contamination to be handled safely.

3.2 Summary Functions and Requirements for the RHWF

Descriptions of some of the key bases for the design of this facility are:

- The RHWF is designed to physically accommodate the outer dimensions and weights of containers and waste items for all 24 waste streams included for processing as part of the Remote Handled Waste System. The RHWF is scheduled to process only 13 of these waste streams, as shown in Table 1 of Ref.5.2, Appendix A.
- The design of the shielding in the walls, doors, and shield windows accommodates the waste streams with radiation fields equal to or less than the fields associated with the most radioactive CPC-WSA jumper box, or 5.7 R/Hr at 16.5 inches from an equivalent 10 foot line source. Other sources include the in – cell pre-filter designed to have a dose rate $\leq$15 R/hr. and filled waste liner may have a dose rate of $\leq$12R/hr. If a filled waste liner contained a pre-filter it would approach 15R/hr.
- The shielding is designed so that the dose-rate in a normally occupied area, such as the Operating Aisle, is no greater than 0.1 mR/Hr.
- The shielding is also designed so that the dose-rate in areas not normally occupied is no greater than 4 mR/Hr to preclude creating a radiation area. The dose in these areas is also limited to less than 500 mrem/yr. based on a time-weighted average for activities performed there.
- All operations personnel at the facility are to be badged for radiation protection. The badging in the office area would be necessary for dose rates greater than 100 mR/year. Since it is desirable to not require badging in the office area, this dose limit was the objective during the design. However the design criteria is to limit radiation dose rates for full time occupancy to less than 0.1mR/hr.
- Two workstations are provided for the Work Cell, each with a shield window to the operating aisle, and handling and cutting equipment operating consoles and CCTV monitors. The RHWF shall have the capability to examine via remote viewing (e.g., CCTV cameras, windows, etc.) the different types of waste. The CCTV system shall be capable of recording all waste processing activities from unpacking, segregation, size reduction, to packaging in the final disposal container. The CCTV system shall provide real-time recording of processing activities and shall maintain continual area monitoring to document container integrity. In addition to real-time recording, the video recording system shall provide advanced video editing features, time-lapse recording, and an uninterruptible power supply. The CCTV system shall provide pan/tilt/zoom cameras with camera control units, and a time/date generator. The video recording system shall provide video and hardcopy records. The system shall provide stand-alone documentation in addition to the WIPP-required supplemental information. There is an

option for the addition of a third station and an additional shield window at a later date. However, this will require alteration to the HPGe system which is presently located at this spare window station. The waste-processing throughput is based on assuming 2 workstations in operation with an availability of 75% each.

- A third station is provided in the Work Cell with a shield window to allow an end view of the entire cell length. This station will have a console for operation of handling equipment and packaging equipment and will have CCTV monitors and a glove box and transfer drawer.
- A shield window is located to view activities in the Buffer Cell from the operating aisle. This viewing station will have Receiving and Buffer Cell crane control and CCTV monitors.
- Unforeseen processing needs can be accommodated by adding up to two expansion modules to the Work Cell.
- Ventilation systems are designed to prevent the migration of airborne radioactive particulates from normally contaminated areas to uncontaminated areas.
- Utility manifolds will be provided inside Work Cell for power, utility air, high-pressure demineralized water, and for decontamination near each work station, and the packaging station.
- Utility manifolds to include water and utility air are provided at the sample area.
- Utility manifolds inside Contact Maintenance Area and Buffer Cell are provided for power, utility air, high-pressure decon water, and demineralized water. Breathing air is supplied outside the airlock to these areas.
- Spare penetrations are provided in the Work Cell for the introduction of high-pressure wash down.
- The RHWF shall collect, store, and process secondary waste streams. An ion exchange system is available and can be remotely installed and operated.

3.3 Discussion

The five main areas directly supporting waste characterization and repackaging through the RHWF are the Receiving Area, Buffer Cell, Work Cell, Waste Packaging Area, and Operating Aisle. Supporting functions are performed in the HVAC Areas, Contact Maintenance Area, Sample Packaging and Screening Area, Load Out/Truck Bay, and Offices. Each area is described below. General arrangements within the RHWF are shown on drawings 911 – D – 030.

3.3.1. Receiving Area

- Purpose: Receive containers of waste transported in a shield box on a transport trailer, or an open trailer with shadow shield, or with a forklift. Allows contained movement of waste into the facility with some shielding provided. Provides the clean bridge crane storage and maintenance area. Acts as a secondary buffer area to ensure confinement of radioactive contamination. Provides weather protection for unloading transport vehicles.
- Radiological Contamination Level: Normally clean but may be slightly contaminated, temporarily.
- Physical Description: (Drawing 911-D-030). Sufficient area to accommodate the largest waste boxes (except for the existing WTF Transfer-Pump box). The Receiving Area consists of a steel-framed metal building. The floor level of the Receiving Area is 4' below the Buffer Cell floor. This will allow containers to be moved from the transport vehicle into the Buffer Cell in

alignment with and at the elevation of the Buffer Cell Power rollers. Two additional Power Roller Systems shall be installed in the Receiving Area to allow containers to be off loaded by a Shielded Fork Truck and moved into the Buffer Cell. Two personnel doors are provided.

- Major Equipment: There is an electrically operated overhead bridge crane with a 20-ton hoist capacity. The crane rails are designed for a 30-ton capacity. The rails extend the full length of the Receiving Area (and into the Buffer Cell). Shielded sliding equipment doors, horizontal swinging contamination control doors, and rising air control doors separate the Receiving Area from the Buffer Cell. CCTV cameras are provided for crane operation.
- Powered roller system (PRS) to move waste containers from the Receiving Area to the Buffer Cell and from the Buffer Cell into the Work Cell will be provided. Linear drive system for the PRS shall be provided in the Receiving Area. The direction of travel on each PRS shall be reversible. The Work Cell PRS shall be remotely replaceable using the bridge crane. The PRS in Receiving Area shall have a structural steel support frame, provided by WVNSCO, to secure the PRS to the floor steel embedments. The Receiving Area and Buffer Cell PRSs shall be locally replaceable using the bridge crane. The following control features shall be provided:
  - Receiving Area and Buffer Cell PRSs shall have local disconnect and control for maintenance
  - Work Cell PRS shall have power, control and instrumentation wiring connectors capable of being remotely connect/disconnected by the PDMs.
  - Each PRS shall have an encoder to provide the limits of travel during operation.
  - Panel lights shall be provided at each station to show status of controls and interlocks
- Design Basis: No shielding is provided by the roll-up truck doors, or personnel access doors. Depending on the radiation levels of the radwaste container brought into the Receiving Area, radiation exposure reduction may be needed. Although during transport a transport shield box can be used, the shield box will not provide shielding while it is being unloaded. Thus, special administrative procedures will be necessary including the use of temporary shielding and / or restricting personnel access to and around this area.
- The Receiving Area has sufficient space to load in the largest box of waste but not the longest WTF Pump box. To process the 50' long WTF Pump box, temporary confinement will need to be installed prior to opening the inner and outer Buffer Cell shield doors. Utility air, utility water and power are provided in the Receiving Area.

3.3.2. Buffer Cell

- Purpose: Acts as an air lock between the Receiving Area and the highly contaminated Work Cell. Allows contained movement of waste containers into the Work Cell with some shielding provided. May be used as a radiologically controlled area for contact-handled operations such as repackaging, swipe sampling or removing large sized waste boxes when radiological conditions do not mandate remote handling operations. The Buffer Cell may also be used for surveying the waste boxes.
- Radiological Contamination Level: 10^4 to 10^6 dpm/100cm^2
- Physical Description: (Drawing 911-D-030). Shielded space with sufficient area to accommodate the largest waste box (except for the WTF Transfer Pump box). The floor of the

Buffer Cell is at the same height as the floor of the Work Cell to allow waste containers to be remotely moved inside using powered roller conveyors. Personnel access to the Buffer Cell is through a double air lock.

- Major Equipment: The crane rails are designed for 30-ton capacity. The rails extend the full length of the Buffer Cell (and into the Receiving Area and Work Cell). A Power Roller system is provided in sections. A shield window, located in the operating aisle wall, allows direct observation of operations within the Buffer Cell. CCTV cameras will be used to monitor areas not viewable from the window. The 20 ton crane will be operated from this window using a portable radio control module. At both ends of the Buffer Cell, shield doors separate the Buffer Cell from the Receiving Area and the Work Cell. Shield doors are wide enough to accept the largest waste container as configured. The waste container basis for doors is in Table 1.
- Design Basis: The Buffer Cell has sufficient space to load in the largest box of waste except for the WTF Transfer Pump box. To process the 50' long WTF Transfer Pump box, temporary confinement will need to be installed prior to opening both the inner and outer Buffer Cell shield doors.

3.3.3. Work Cell

- Purpose: Primary work zone within the RHWF for fully remote handling, surveying, segmenting, decontaminating, and repackaging operations. Unforeseen processing needs can be accommodated by adding up to two expansion modules to the Work Cell.
- Radiological Contamination Level: $>10^{12}$ dpm/100 cm^2
- Physical Description: (Drawing 911-D-030). Shielded space (55 feet long by 22 feet wide by 37 feet high, 26+/- feet high to the bridge crane rail supports) with sufficient area to work on the largest and longest waste boxes, including a 50' long WTF Transfer Pump box. Space is provided to operate up to three workstations (two are presently provided). There is also additional space for staging incoming waste containers and temporary storage of waste disposal drum and box liners.
- Major Equipment: The conveyor system is provided in sections. The crane rails are designed for 30-ton capacity that extends the full length of the Work Cell. Two bridge cranes will be provided. One hot (contaminated) X, Y, Z Bridge Crane designed for a 30 ton capacity load is provided with a 30-ton cable hoist. The other hot (contaminated) work cell bridge crane will be provided with two (2) telescoping masts. The telescoping masts, supported by separate bridge crane trolleys, are capable of utilizing various tools. One jib with a telescoping mast can be moved on a rail along the length of the cell wall. CCTV cameras are used to view operations in the Work Cell. The RHWF shall have the capability to examine via remote viewing (e.g., CCTV cameras, windows, etc.) the different types of waste. The CCTV system shall be capable of recording all waste processing activities from unpacking, segregation, size reduction, to packaging in the final disposal container. The CCTV system shall provide real-time recording of processing activities and shall maintain continual area monitoring to document container integrity. The jib and bridge cranes are used for handling of material throughout the cell. In addition, various interchangeable tools including heavy duty cutting equipment, PDM's and PDM's with light duty cutting equipment can be used on the jib crane and bridge crane with telescoping masts. PDM's are capable of supporting GM detectors with collimator shield. Heavy duty cutting is planned for tools attached to the bridge crane 3 ton capacity telescoping

mast. The PDM's are interchangeable between the bridge crane telescoping masts and jib crane telescoping mast. The PDM's and cranes are used to operate a full range of fixtures and tools for handling, surveying, sampling, segmenting, and repackaging waste. The specifics are described in SDD R01.

Portable work tables allow simultaneous waste processing operations for two operators located behind the two shield windows in the Operating Aisle wall. Size reduced or sorted waste pieces are temporarily stored in liners while being filled prior to being transferred out of the Work Cell through the Waste Packaging System.

Work tables in the Work Cell are positioned above the in-cell filters. Note: The in-cell filters are HEPA-type, but cannot be PAO tested. The exhaust airflow from the Work Cell is drawn from the work tables area. The airflow to the in-cell filter intakes are positioned along the wall and then through ducts in the wall to the HVAC final HEPA filter system located on the first level below the Operating Aisle.

In addition to major equipment the Work Cell area will have embeds and / or fixtures for holding equipment, tooling, lifting beams when not in use. Provisions are available in the Work Cell to wash-down / decon equipment. (Refer to SDD R01 and SDD R07).

Two "knock-out" sections in the outer wall of the Work Cell allow for future addition of Expansion Modules. Removable steel wall panels serve as inner confinement barriers until an Expansion Module is installed. An externally removable shield wall consisting of reinforced precast concrete sections held in place by vertical slots built into the concrete structure on each side provides shielding for these "knock-out" sections.

- Design Basis: For processing waste containers with dose-rates higher than the design basis dose-rate (as decayed from the measured value of 15 R/hr), operators will need to keep sources more than 2' from the wall, add temporary shielding, or impose access restrictions.

3.3.4. Waste Packaging Area

- Purpose: Provides a confined and shielded space for efficiently loading out filled waste drums and boxes. The Waste Packaging System mounted within the Waste Packaging Area provides the physical boundaries necessary to bring material out of the Work Cell Area with radiological contamination levels greater than 10^{12} dpm/100 cm^2, while maintaining the exterior of the shipping package clean. The Waste Packaging Area also provides the third confinement zone outside the Work Cell, the second confinement zone being provided by the airlock design of the Waste Packaging System.
- Radiological Contamination Level: Waste Packaging Areas that become slightly contaminated, especially the transfer port, will be decontaminated back to clean levels.
- Physical Description: (Drawing 911-D-030). A Waste Packaging System including provisions for drums and boxes is installed within the Waste Packaging Area inside the Work Cell. The Waste Packaging Area is isolated from the main area of the Work Cell by shield walls to form a container loading area. Steel doors seal off the rear of the Waste Packaging Area from the Survey/Spot Decon Area. There is sufficient space to allow a forklift in the Survey/Spot Decon Area to pick up filled drums and boxes. The floor elevation of the Survey/Spot Decon Area is at the same elevation as the Load Out/Truck Bay to facilitate moving filled containers to the Load Out/Truck Bay for loading onto vehicles. The Survey/Spot Decon Area provides space for

surveying and spot decontaminating filled waste containers. This shielded confined space has sufficient area for loading a drum or a box.

- Major Equipment: Two Transfer Systems (one for drums and one for boxes) are installed within the Waste Packaging Area inside the Work Cell. A drum cart is designed to convey a drum into the Waste Packaging Area. A box cart is designed to convey a LLW box into the Waste Packaging Area. An Area Radiation Monitor is installed on the wall of the Waste Packaging Area to monitor radiation levels in the area. Continuous Air Monitors measure the airborne radioactivity. The capability to take contamination swipes prior to opening the exit shield doors is provided. The swipes are transferred to swipe transfer tubes in the shield walls. A 3T monorail transfer hoist is installed on the ceiling of the Survey/Spot Decon Area to assist in handling covers for shielded drums.

  When not in use, the ports of the Waste Packaging Systems are maintained clean by Packaging Area Covers.

- Design Basis: The Waste Packaging System will provide for packaging the design base waste into 55-gallon drums and B-25 Boxes. An effective contamination control boundary shall be maintained.

3.3.5 Operating Aisle

- Purpose: Provides a clean space for remotely operating facility equipment.
- Radiological Contamination Level: Always maintained clean.
- Physical Description: (Drawing 911-D-030). Long aisleway outside the Work Cell and Buffer Cell at the second floor elevation.
- Major Equipment: Three shield windows are installed in the Work Cell walls. A frame with a concrete shield plug (i.e., no installed window) is provided for installation of an additional shield window and workstation for future expansion. This area is presently allocated to the HPGe assembly, which may have to be relocated when future expansion takes place. Operation workstations are located at the two shield windows located in the long Work Cell wall. These allow direct observation of all operations to be performed by the remote handling equipment within the Work Cell. An additional workstation is located at a third shield window with a view down the length of the cell. This third work station has the primary function of loading a 55-gallon drum liner or a B-25 box liner into the Waste Packaging System. In addition, sample operations are performed at this window.

  MCCs and C&I cabinets will be located in the Operating Aisle. The location of these MCC's and cabinets will be such that there is sufficient clear space for Master Slave Manipulator installation and removal for the maintenance of the Master Slave Manipulators. Wall plugs for the MSM ports on the east wall of the Operating Aisle shall be provided. These plugs shall be made of decontaminable materials. The RHWF shall also provide an I-beam and trolley system to be used for the installation and removal of the MSM assemblies. The I-beams shall be supported from embedded plates in the ceiling.

- CAMs and Radiation monitors are located in the aisleway.

- Design Basis: Additional controls (not included in the current RHWF design) may be needed for processing high dose-rate waste containers, such as the Dissolver Vessel Boxes. More detail is provided in SDD R03.

3.3.6 HVAC Areas

- Purpose: The Mechanical Equipment Area houses the air handling system for the make-up air distributed to the stairwells and operating spaces within the RHWF. The Exhaust Blower Room provides an isolatable space for the large blowers that pull air from the Work Cell through the HEPA filters. The Exhaust Filter Area provides an isolatable space for changing final HEPA filters.
- Radiological Contamination Level:
  - Mechanical Equipment Area: Always maintained clean.
  - Exhaust Blower Room: Always maintained clean.
  - Exhaust Filter Area: Clean. Slight contamination during filter change-out will be decontaminated back to clean levels.
  - Physical Description: (Drawing 911-D-030). The Mechanical Equipment Area is located on the third floor of the facility. The Exhaust Filter Area and Exhaust Blower Room are on the first floor. Equipment located in these areas typically requires hands-on maintenance. A monorail hoist on the first floor ceiling and access doors allow movement of equipment and consumables (filters).
- Major Equipment: The make – up air system consists of heaters, blowers, chillers, and intake filters. The exhaust air system consists of blowers, motors, and dampers, HEPA filters, filter housings, and exhaust filter test equipment. Provisions to allow movement of equipment and consumables for the HVAC equipment include floor hatches and/or access doors from the Load Out Truck Bay.

3.3.7 Contact Maintenance Area

- Purpose: Provides a shielded zone isolated from the Work Cell where personnel can perform maintenance on the crane, powered dexterous manipulators (PDM's), and other equipment removed from the Work Cell.
- Radiological Contamination Level: 10^4 to 10^6 dpm/100 cm^2
- Physical Description: (Drawing 911-D-030). The Contact Maintenance Area is located at the far end of the building adjacent to the Work Cell. The maintenance area has two main floor levels; the lower level is located on the first floor of the building while the upper level is located on the third floor. In addition to the main floor levels, an intermediate level work platform is provided for maintenance of the crane's telescoping tube. The crane enters the maintenance area through slotted openings at the end of the Work Cell. To provide a barrier between the maintenance and Work Cell areas, shield and air control doors are provided. Personnel access to the upper and lower levels is through double airlocks.
- Major Equipment: The first floor of the maintenance area contains a laydown area and storage space for the tools. A workbench, holding fixtures, and tool storage area is also provided for hands on maintenance of the heavy duty and light duty tools, jib crane, or crane telescoping

tubes. A steel ladder is provided for access to the intermediate work platforms and upper maintenance area.

The upper level floor is of concrete and structural steel construction with a slotted opening in the floor (covered with removable plates and/or handrails when not in use) for traversing of the crane's tube. A bridge mounted maintenance hoist is located above the bridge crane to assist with removal of crane components and handling heavy items. The crane's power and control cable management system is also located on the upper floor level.

- Design Basis: Equipment may be washed down in the Work Cell, prior to transfer to the Contact Maintenance Area to reduce the contamination levels and radiation dose rates for contact handling.

3.3.8 Sample Packaging and Screening Area

- Purpose: To transfer swipes and sample bottles into the cell and to remove samples from the Work Cell and place the samples in containers for transfer to a laboratory for analyses.
- Radiological Contamination Level: Always maintained clean.
- Physical Description: (Drawing 911-030) The Sample Packaging and Screening Area consists of an area at the end of the Operating Aisle and outside the end shield window for the Work Cell and Master Slave Manipulators to handle samples.
- Major Equipment: A sample shelf is located in the Work Cell below the sample transfer drawer, which is mounted inside the shield wall. The samples are removed from the transfer drawer inside a sample transfer glovebox. The contained samples can be transferred via glove box to a sample shield pig or to the sample hood. Samples can also be pre-screened and counted for gross activity with counting equipment available in the area.
- CAMs and Radiation monitors are located in the area.
- Design Basis: Samples greater than 1 kilogram in weight, 1 liter in size, or reading over 50 mR/hr need to be transferred out of the Work Cell through the Waste Packaging System Area.

3.3.9 Wash Down Collection Tank Room

The Wash Down Collection Tank Room has tanks which collect waste from the wash down and / or decontamination of Work Cell Walls and floors, Buffer Cell Walls and floors, Waste Packaging Area, and Contact Maintenance Area as well as the washdown of components contained in these areas. The washdown water is collected by drainage into the sump. The washdown waste is filtered and then collected in the Waste Collection Tanks (Reference SDD R06). Waste Collection and Transfer System is designed in accordance with DOE Order 435.1.

3.3.10 Truck Loading Area and Office Space

The Load Out/Truck Bay is a weather-enclosed structure for loading of containerized waste material on to transport vehicles. The proposed truck loading area will be a pre-engineered metal building with a clear span of approximately 63 ft long by 51 ft. wide. The long axis is oriented in the north-south direction.

The Office is a two-story structure for the RHWF operations personnel. The office space will be a two level structure with approximately 1100 sf of floor space on each level. The office area is located at the far south end of the facility.

Truck Loading

- Purpose: To load out filled waste containers, bring in and store empty waste containers inside an all-weather enclosure.
- Radiological Contamination Level: Always maintained clean.
- Physical Description: (Drawing 911-D-030). The Load Out/Truck Bay consists of a clear span pre-engineered building (approx. 63 feet by 51 feet), with metal wall and roof system.

The building will have three overhead roll-up doors allowing for vehicle access from the north, south and east. The building accommodates, with its doors closed, a semi trailer of nearly 50 feet in length. This may be required during inclement weather or when the loading operation is extended over multiple shifts.

Offices

- Purpose: To provide a clean area adjacent to the low dose rate end of the RHWF for performing administrative functions.
- Radiological Contamination Level: Always maintained clean.
- Physical Description: (Drawing 911-D-030). Built adjacent to the low dose end of the RHWF (outside the Contact Maintenance Area) as a two story office facility with about 2000 sq. ft of floor space for crew offices, meeting rooms, a lunch room, and sanitary facilities.
- Major Equipment: Personnel Contamination Monitors (PCM) are located on all access routes from the RHWF to the Offices.
- Design Basis: The walls of the fire-rated stair wells provide additional assurance that transient radiation levels (from trucks in the Truck Bay) will not cause dose rates within the office areas to exceed 0.1 mR/hr or 100 mrem per year. In order for the office area to not require badging the radiation dose rate must be limited to 100 mr/year.

4.0 PHYSICAL AND EQUIPMENT DESCRIPTIONS

4.1 Technology / Equipment General Objectives

This section provides a general overview of the technology and equipment identified for the RHWF. More detailed descriptions are provided in the individual SDD's listed in Section 1.0. This section addresses the overall engineering design approach, and identifies the major equipment selected for the facility to meet the following process requirements and project goals:

- Provide a system design with the flexibility to be upgraded to meet future needs
- Provide a system design which has a high confidence level of success
- Provide a system design with a high availability
- Provide a system design which minimizes the potential for the spread of contamination and meets ALARA practices
- Provide a cost effective design which meets all of the above goals

The design bases include the following general objectives:

- Utilize proven technology and commercially available equipment to the greatest extent possible to minimize cost and provide high confidence level of success
- Utilize off-the-shelf equipment to the greatest extent possible to minimize cost, provide high confidence level of success, and provide high equipment availability
- Utilize PDMs and interchangeable tools to accommodate the specialized tasks associated with the processing of waste and maintenance of equipment, to provide a cost efficient system which can be upgraded to address future needs
- Utilize commercial X, Y, Z Bridge type and jib type cranes.
- Segregate operations with the greatest potential for spreading contamination from those with minimal or no potential to spread contamination, to provide a safe operating environment, minimize personnel exposure, and to minimize maintenance and decommissioning costs

4.2 Equipment and Technology

The RHWF consists of a concrete shielded area, divided into three separate cells, for processing of the waste, a Contact Maintenance Area for maintaining the in-cell handling and cutting equipment, and a Waste Packaging Area for removing waste containers. Equipment needs are defined for performing the process operations identified for each of these areas. The identification and selection of this equipment was based on the project goals and engineering design approach discussed above. The design was modeled after the equipment provided for similar facilities developed for the DOE. The following sections provide a summary overview of the equipment and technology selected for the RHWF.

4.2.1 In – Cell Handling Equipment (Work Cell Area)

The primary handling operations which need to be accommodated within the facility are waste container load-in, waste container load-out, waste item handling and transport, and equipment handling and transport. Each of these operations is a unique task due to the variations in the configuration of the materials and items, which need to be handled. As a result, several different types of systems are required to perform these operations. In order to minimize the number of the different types of systems needed, some of this equipment was configured to utilize interchangeable light and heavy-duty tools. These tools, which can be configured for a specific task, will utilize a common positioning/transport system. The motions (Degrees of Freedom) required to perform flexible tasks are divided between the main positioning system, which can now be a simple X, Y, Z positioning system, and the PDMs which

can accommodate other motions as required. SDD R01 provides a more detailed description of the handling equipment.
To maximize design flexibility while minimizing system complexity, the material handling equipment provided to grapple, lift, support, and transport a wide range of different size and shape components and piece parts has the following features:

- ♦ All movement of heavy waste boxes and drums into the facility will be by Powered roller systems or overhead bridge crane. All load-out of waste boxes/drums from the Waste Packaging Area will be accomplished using a mobile cart system.

The equipment needed for each handling task have been identified and are as follows:

- Power Roller systems or the overhead bridge crane are used for loading-in of waste boxes.
- Transfer carts are used for the supporting and positioning of drums and boxes in the Waste Packaging Area.
- The jib crane, bridge cranes, and manipulators identified for material processing, are provided with the ability to interface with different types of tools. In addition, these tools are interchangeable between the different types of in-cell handling equipment.

4.2.2. In – Cell Cutting Equipment

A variety of different items have been identified as requiring cutting operations. These items range from piping to large multi-shell vessels. This wide range of structures, shapes, sizes, and materials does not lend itself to any one type of cutting tool. Therefore, a variety of different types of cutting tools in a range of sizes will be required to ensure a successful campaign. Two size categories of cutting tools, i.e. light duty tools and heavy-duty tools are provided. Components that are encapsulated in concrete or grout may be size reduced by use of breakers and saws. SDD R01 provides a more detailed description of the cutting equipment.

4.2.3. Shield and Air Control Doors

Shield and air control doors are provided at the interface between each cell in the shielded section of the building structure. They are located at the entrance to the Buffer Cell, the Work Cell, and the Contact Maintenance Area. They cover the complete access opening to minimize the spread of contamination from the Work Cell to the other cells. The Buffer Cell and CMA are also considered contaminated but to a lesser extent. The doors for these areas also control the spread of contamination. These doors cover a common opening which has been sized to permit the waste boxes to be transported into the cells in addition to permitting the bridge crane to travel from cell to cell for recovery from off-normal events. SDD's R03, (Shielding) and R08, (Air Control), provide a more detailed description of these doors.

Precautions have been taken to prevent the spread of contamination from the Work Cell to the other areas of the facility. These precautions include the provision of the shield doors, air control door, and the appropriate HVAC airflow profile.

4.2.4 Contact Maintenance Area

<u>Maintenance Crane</u>

An underhung electrically operated overhead bridge crane of 5 ton capacity is provided in the Contact Maintenance Area, which supports maintenance activities. A description of this equipment is provided in R01.

4.2.5 Ex-Cell Handling Equipment

There are various types of handling equipment provided in support of ex-cell activities. This equipment will consist of commercial equipment as follows:

- Monorail Hoist: Supports maintenance activities in the Exhaust Filter Area and handling of covers for shielded drums in the Survey/Spot Decon Area.
- Fork Truck: Handling and transport of loaded 55-gallon drums and LLW boxes in Load-Out Bay (Supplied by owner)

A description of this equipment is provided in SDD R02 and SDD R08.

- Mechanical equipment can be maintained or replaced through hatches in the roof or doors into the truck bay.
- Consideration for maintenance of MSMs will include accessibility from the Operating Aisle to the Loadout Truck Bay.

5.0 SYSTEM SUMMARY DESCRIPTIONS

5.1 Remote Processing System

The Remote Processing system is described in detail in SDD R01.

5.2 Waste Packaging System

5.2.1 Packaging Process

The waste packaging area and associated equipment will be used to remove a drum liner, or a box liner, loaded with waste from the Work Cell. Only loaded liners are removed from the Work Cell, not the final waste disposal containers (drums or boxes). A loaded liner is removed from the Work Cell through a transfer system port into a waiting drum (or box) on the outside of the Work Cell. The transfer system allows the loading of the liner into the final waste disposal container such that the exteriors of the waste container remains clean (uncontaminated from radioactivity in the Work Cell). This area of the facility and the associated waste container handling equipment provide shielding for the operators as needed.

5.2.2 Remote Sampling and Analysis Subsystem

5.2.2.1 Purpose

The Remote Sampling and Analysis Sub-System will be used to transfer swipes / sample bottles, etc., into the cell and to remove samples from the Work Cell into a glove box, perform dose-rate and contamination surveys on the samples using survey meters. The samples will then be loaded into clean containers for transfer to laboratories for analysis. The details of this sub-system are provided in R02

5.2.2.2 Design Basis

Samples of up to 1 kilogram in weight and 1 liter in volume with dose rates up to 50 mR/hr on contact can be processed through a shielded glove box. Dose rates caused by all samples collected inside the shielded glove box are to be limited to 100 mR/hr. Samples exceeding these values can be remotely transferred out of the work cell through the Waste Packaging System designed for removing 55-gallon drum liners.

5.2.3. In-Cell Radiological Assay Systems

5.2.3.1 Summary

The following instruments will be installed in the Work Cell:

- a movable GM detector in a collimator shield attached to a PDM
- a fixed GM detector in a collimator shield mounted in the shield wall with a low-exposure rate line-of-sight view across the Work Cell
- a high purity germanium (HPGe) detector with shield.

In addition to these instruments, samples may be taken and analyzed, external to facility, to determine the mixture of transuranic radionuclides and amount of Sr-90 present in the waste, aid in calibration of counters, establish scaling factors for converting exposure rates to equivalent radioactivity, and provide statistically valid quality control.

5.2.3.2 Exposure Rate Survey Instruments

Two instruments will be provided for measuring exposure rates on pieces of waste inside the Work Cell:

- A GM detector inside a collimator shield which is attached on a PDM and moved to any location within the Work Cell, and
- A GM detector inside a collimator shield in the Operating Aisle shield wall located where pieces of waste can be positioned at known distances in front of the detector.

The in-cell mobile detector can be used to survey most objects in the Work Cell but it has the disadvantage of picking up interfering exposure rates from any other sources along its line-of-sight or in the near proximity to its collimator shield. Therefore, a second GM detector is mounted in a collimator shield embedded in the shield wall at a location where the only source in its line-of-sight (across the Work Cell) is the waste piece of interest lifted into position at a known distance in front of the detector.

5.2.3.3 High Purity Germanium (HPGe) Detector (With Spectrum Analyzer)

A high purity germanium (HPGe) detector with shield, shutter, detector, electronics, software and hardware will be installed to monitor items in the Work Cell. Reference WVNS-FRD-027, dated Feb.19, 2002.

5.3 Shielding Design

The shielding analysis performed to support the design development of the Remote Handled Waste Facility (RHWF) is summarized in this Section. The objective of the shielding analysis was to define the shielding requirements, which ensure that radiation levels in occupied areas of the RHWF are in compliance with the WVDP's dose limitations and the intent of the ALARA Program. Specifically, the design basis dose rate is equal to 0.1 mrem/hr for normally occupied areas. A higher allowable dose rate is permitted in an area if the area is not normally occupied. In general, the allowable dose rate increases as the expected duration of occupancy decreases.

The shield thickness required, is a function of the allowable dose rate for a particular area. The product of the shielding analysis was not a single specified shield thickness, but rather a presentation of the dose rate as a function of shield thickness. This allowed the designer to determine shielding requirements based on estimated occupancy factors.

This shielding analysis was supplemented by several analyses performed to verify the adequacy of the selected shield wall thicknesses for source terms generated during waste processing activities, for example, waste collection tanks and in cell filters.

The key parameters in performing the shielding analyses are as follows:

- Source geometry (shape of the source)
- Source to dose point geometry
- Radionuclides to be shielded
- Concentration of radionuclides to be shielded

These factors are discussed in SDD R03, along with others that affect the results. SDD R03 describes the overall shielding design.

5.3.1 Shield Doors

This section summarizes information on the shield and air control doors located at the entrances to the Buffer Cell, Work Cell, and Contact Maintenance Area. The purpose of these doors is to prevent spread of contamination from one area to another and to provide radiation shielding from the waste containers and their contents. The design is detailed in SDD's R03, R04, and R09.

Three types of doors are used for shielding and contamination control. The lower shield doors are heavy steel track-mounted sliding doors to provide maximum shielding. In the permanent wall section above the shield doors an opening is provided through which the cranes can pass. For entrances to the Buffer and Work Cells, the lower portion of this wall has a small shield door that, when opened, allows passage of the crane cable and hook. The upper portion of the opening which is wide enough to allow passage of the crane, is sealed with an air control door. The lower shield door to the Contact Maintenance Area is sized to allow passage of the extended telescoping tube and PDM. The air control door above is configured the same as for the Receiving Area and the Buffer Cell.

All three types of doors will reduce air leakage to the extent necessary to support the HVAC systems to maintain the differential pressures and air flow rates necessary to control the spread of radioactivity.

The shield and air control doors cover a common opening that permit the waste boxes to be transported into the cells in addition to permitting the bridge cranes to carry a load from cell to cell, for recovery from off-normal events, or to be moved into the Contact Maintenance Area.

5.3.2 Shield Windows

The proposed strategy for the Remote Handled Waste Facility (RHWF) is to provide the operators with a shielded portal to view the activities being performed in the Buffer Cell, Work Cell, and the Packaging Station areas.

The RHWF shield windows provide the means to view the activities in the Buffer Cell, Work Cell, and the Waste Packaging area. The centerlines for all the windows are strategically located in the Operating Aisle to provide the operators a view of the work being performed. The layout of the RHWF and locations of shield windows are shown on Drawing 911-D-030, Sheets 1 through 6, "General Arrangement".

The purpose of the shield windows is to enable operators to view activities in the contaminated areas of the RHWF and shield them from the radioactive sources. The shield windows will provide sufficient viewing for the operators to perform the required tasks at each of the locations without significant body movement. The following windows are provided: one window for the Buffer Cell; two windows for the Work Cell; and one window for the sample Station. Controls for operators are located at each of the windows.

Specific design criteria for the shield windows are the following:

- Maximum dose rate in the Operating Aisle will be 0.1 mR/hr.
- Viewing angles are based upon operators seated on barstools at the workstations at each of the shield windows.
- Eye level is approximately 60 inches above the Operating Aisle floor.
- Normal and extreme viewing angles are based on an operator situated 20 inches from the window.
- All normal work performed at the various shield window locations are within the normal viewing angle for the window.
- Extreme viewing angles allow operators to view areas of the cells that may be of interest.
- CCTV viewing is also available to augment the viewing available from the shield windows.
- A hotside cover glass will be included on all shield windows.

5.4 Radiation Protection Systems (ALARA)

5.4.1 ALARA Features Designed into the RHWF

The sorting, segmenting, and repackaging of contaminated radioactive wastes, in preparation for off-site disposal must be performed in an area or facility that provides suitable confinement to prevent the spread of contamination, shielding and remote handling technologies to ensure that radiation doses to personnel are minimized. ALARA principles must be factored into the initial facility design to ensure safe, efficient, and cost effective operation.

The preliminary design has retained the ALARA features established during the Conceptual Design. In addition, during Preliminary Design the ALARA checklist, (See Appendix C and SDD R04) was used by the ALARA engineer as a guide to consider ALARA requirements.

The ALARA features, which have been incorporated into the design of the RHWF, are discussed in SDD R04. Due to their wide ranging diversity, the features design have been grouped into the following categories: general arrangement, shielding and access, remotely operated equipment, equipment maintenance, airborne radioactivity control, and radiation and airborne radioactivity monitoring.

The RHWF has been designed to keep exposures ALARA to operators processing radioactive waste and to support personnel. This has been achieved by creating a facility with three levels of confinement in which the major radwaste processing functions are performed remotely. While this ensures that dose to the operators and waste handlers have been minimized, additional features and controls have been incorporated to ensure that radiation exposures are also kept ALARA for other personnel such as those required to maintain, repair, and calibrate the equipment.

5.4.2 Airlocks / Cell Entry

Airlocks are provided for personnel entry into any area that requires control of radiological contamination using ventilation as an engineered barrier. Doors for access to highly contaminated areas within the Remote Handled Waste Facility (RHWF) require special features that are described in SDD R04. In accordance with WVNS guidance, double airlocks are shown for personnel access to the Buffer Cell and both levels of the Contact Maintenance Area.

Personnel air locks are located at all entrances to areas where loose surface contamination levels are expected to routinely exceed 200 dpm/100 sqcm gross Beta or 20 dpm/100 sqcm gross Alpha. The size, location, and arrangement of the doors for each personnel air lock are shown on Drawing 911-D-030 for the Buffer Cell, and Contact Maintenance Area. A total of three personnel air locks have been provided for entry to the:

- Buffer Cell (First Level)
- Contact Maintenance Area Lower Level (First Level)
- Contact Maintenance Area Upper Level (Third Level)

5.4.3. Criticality

The nuclear criticality concerns and the safety associated with the RHWF are discussed in SDD R04. The criticality safety has been comprehensively addressed for the WVNS site. As discussed in the RHWP PSAR the estimated amount of fissile material (U-235) is less than the minimum critical mass. The history and evaluation have determined the majority of any fissile material will remain with the contaminated items. However, because of small uncertainties with the fissionable material double contingency (as discussed in DOE Order 40.1) is applied.

The capability to sample the waste transfer tank is provided to collect samples, which can be analyzed at site facilities to assure fissionable material transported from the RHWF is within prescribed limits.

5.5 Radiation Monitoring System

5.5.1 RHWF Stack Airflow Monitoring and Particulate Sampling

5.5.1.1 Introduction

The design implements the 1999 version of ANSI N13.1 to the maximum extent feasible, although the standard was released after the initiation of project. The implementation is based upon the methodology described in "Design Evaluation of the Actinide Packaging and Storage Facility (APSF) at Savannah River for Compliance with EPA Single Point Aerosol Sampling".

5.5.1.2 Summary

The RHWF Stack Effluent Radiation Monitor System consists of a Continuous Air Monitoring (CAM) System and a Continuous Air Sampling (CAS) System.

The CAM System comprises two individual Alpha/Beta (combined unit) monitors, with one monitor operational and one in standby. The monitors share a common vent stack sample probe and supply piping (tubing). Two vacuum pumps, one operational and one in standby, produce system flow.

The CAS System consists of two individual [paper] air samplers, with one operational and one valved off (zero flow) as the alternate. The samplers share a common vent stack sample probe (separate from the CAM sample probe) and supply piping (tubing). Two vacuum pumps, one operational and one in standby, produce system flow.

The RHWF Stack Effluent Monitoring System is a “flow-following” system. Mass flow is measured in the facility vent stack and CAM/CAS flows are varied in response to stack flow, within maximum and minimum limits.

Design guidance provided by the Texas A&M University as a result of actual scale tests, as summarized in their Final Report – “Application of Single Point Representative Air Sampling to the Remote Handled Waste Facility (RHWF) Stack,” by Texas A & M University, Report # 6833/05/15/03, is also considered in the design.

The system is described in SDD R05.

Design Criteria

Representative particle samples must be withdrawn from stacks to demonstrate that they meet the requirements of 40 CFR 61 subpart H "National Emission Standards for Emissions of Radionuclides other than Radon from DOE Facilities".

5.6 Waste Collection & Transfer System

5.6.1 Cell Drainage/Collection/Transfer

The RHWF requires a Liquid Waste Collection and Transfer System which is designed in accordance with the requirements of DOE Order 435.1. Liquid waste will be generated through equipment decontamination and cell wash down. These activities are expected to occur periodically, primarily in support of routine maintenance activities or as part of “housekeeping” procedures.

A Work Cell wash-down is estimated to generate 1,200 gallons of wash water. In addition, small quantities of liquid may occasionally be contained/trapped within components being processed or in the storage boxes which hold them.

Buffer Cell and Contact Maintenance Area wash-downs are estimated to generate half the volume of a Work Cell washdown, or 600 gallons.

Equipment decon and washdown of the Waste Packaging area is considered to generate one quarter of a Work Cell washdown or 300 gallons.

The cell drainage liquid waste collection and transfer system are described in SDD R06.

5.6.2 Waste Container Dewatering

The waste to be processed within the complex of locations forming the RHWF will consist of waste currently in storage and waste to be generated as remediation efforts at the West Valley Demonstration Project (WVDP) site continue. Future wastes can be prepared so as to preclude the inclusion of liquids in the waste container. However, there is no certainty regarding the liquid content of the “dry” radioactive waste containers currently in storage. Although these wastes were not intended to be packaged containing liquids, it may be possible that liquids were trapped in some process components. Another possibility is that temperature changes might have resulted in water being condensed from the air inside the containers. This should have been a reversible process resulting from the temperature induced "breathing" of the waste containers. Also, the Recycle Evaporator and the Low-level Waste Accountability Tank were reported to have had a layer of sludge about one foot thick on their bottoms when placed into the CPC-WSA. Given that there is a possibility of liquids in some of the dry waste containers, provisions for waste container dewatering are needed.

The capability for dewatering packaging containers is included in the proposed design features of the RHWF. Details and discussions are provided in SDD R06. Acceptance criteria for the planned disposal site are provided in an Appendix of SDD R02.

5.7 Decontamination Provisions / Decontamination Systems

Decontamination provisions that were employed within the RHWF fall into two categories: Waste decontamination and equipment/facility wash down capabilities. Waste decontamination capabilities integrated into the RHWF, as well as features to deal with secondary waste generation, are summarized in the following subsections with details provided in SDD R07.

5.7.1 Waste Decontamination

One objective of waste decontamination is to remove those radionuclides that cause the waste to be classified as transuranic (TRU) waste and change the waste classification to low-level waste (LLW) thus reducing the overall cost for waste disposal. Another objective is to reduce the dose rate from the packaged waste and to minimize the spread of contamination during processing.

The design of the RHWF does not include installed equipment or systems for aggressive waste decontamination. This does not mean, however, that waste decontamination will not be implemented. The decision to decontaminate individual waste items should be made only after the merits/benefits can more accurately be predicted. The reason for this approach is that the information needed for making the appropriate technical decisions does not exist at this time, and will not exist until the waste is being processed and the data can be collected. In support of this approach, the following three provisions were made:

1) Waste items found to contain TRU waste are to be separated from the bulk of the waste.
2) The TRU waste will be temporarily stored until sufficient data (such as total volume) is available to assess the viability of aggressive decontamination.
3) Incorporate into the RHWF provisions to accommodate the later implementation of aggressive waste decontamination technologies at a later date, if required.

The designs included with the RHWF use demineralized water or utility water for flushing and spray down.

5.7.2 Facility and Equipment Decontamination

Means are needed to remove particulate surface contaminants from inside waste packages, from cutting operations or from other airborne waste deposition. The provisions incorporated into the design of the RHWF are discussed in the following subsections. The objectives of the decontamination capabilities provided are as follows:

1) Prevent the spread of contamination within the RHWF;
2) Ensure exposure to maintenance personnel are ALARA; and
3) Prevent the buildup of general area radiation levels from the deposition of radioactive material primarily within the Work Cell and Contact Maintenance Area.

Decontamination Provisions for the Work Cell

The Work Cell is designed with down draft ventilation system to collect the radioactive particulate matter as it is generated during the waste segmenting process. This is described in SDD R08. Although this reduces contamination, there will still exist the need to provide decontamination of this area.

Vacuum cleaners will also be used for decontamination / housekeeping.

The PDM's can also use a spray wand for wash downs.

A ceiling mounted spray header is installed in the Work Cell. This header is designed and located such that the bridge cranes are washed down while still in the Work Cell and while traveling under the spray header. The jib crane will be capable of being washed down by a bridge crane PDM before entering the Contact Maintenance Area. Similarly, a PDM can be used to assist the ceiling mounted spray header to wash down the bridge cranes or other PDM before either crane enters the Contact Maintenance Area.

Decontamination Provisions for the Contact Maintenance Area

In addition, standard power wash wands will be located in the Contact Maintenance Areas. This type of wand has a single spray nozzle at its end and will be manually handled by operators in anti-contamination clothing. This capability is installed as a backup to the Work Cell wash down capabilities, and as a means to perform very localized decontamination should it be needed.

Decontamination Provisions for the Buffer Cell

The Buffer Cell is personnel accessible through an airlock. Thus, manual wipe down of the cell would be possible. However, due simply to the size of this area, the total labor hours involved, and even if the ambient background radiation levels were low, the final total aggregate personnel exposure could be significant. Thus, use of a crane and pipe-spray wand, might be used for any extreme decontamination efforts. The Buffer Cell does have a floor drain connected to a 750-gallon collection tank.

Decontamination of the Airlocks and Waste Packaging Area

These areas are relatively clean and the walls and floor have epoxy coatings making them very smooth and easy to wipe down. Manual wipe down of these areas would be the preferred approach to decontaminate. The Waste Packaging Area has penetrations that are used to insert nozzles for spraying down a waste container, if required. The Waste Packaging Area has stainless steel lined floors and walls including an area for potential decontamination of Waste box liners and drain liners.

Spray Nozzles

Of the various nozzle spray patterns available, the three most viable candidates for decontamination applications are the solid streams, full cone, and flat/fan spray. For the crane and equipment wash down operations, the spray nozzle is a full cone type for most surfaces. The other two spray nozzles should be available for special cases. For the in-cell wash down pipe wand, the recommended nozzle spray pattern is the flat/fan pattern. This spray pattern would permit the "sweeping" of the surfaces, as well as directing the movement of removed particulate matter.

Both spray wands use high-velocity low-flow nozzles. This will limit the generation of wash water while benefiting from the removal "power" provided by the kinetic energy of the high velocity water.

Complete discussions of all decontamination provisions are included in SDD R07.

5.8 HVAC Systems

5.8.1 Un-contaminated Area Ventilation Systems (Supply)

This section covers ventilation supply air to un-contaminated areas of the Remote Handled Waste Facility (RHWF). Supply air to the contaminated areas is supplied by exhaust and infiltration from the uncontaminated areas.

The design for managing the airflow for the Remote Handled Waste Facility (RHWF) is included in SDD R08. The system is designed to contain radiological contamination without extensive ductwork, dampers, or transfer-filters. As part of the overall RHWF design the building structure is a secondary confinement, and is designed to prevent migration of radioactive material from the Work Cell to the environment.

Air Supply #1 - This system consists of conditioned air (filtration, heating, and AC) to the stairwells, Exhaust Filter Area Airlock, Airlocks to Buffer Cell and Contact Maintenance Area, Survey/Spot Decon Area, Exhaust Blower Area, Mechanical Equipment Area, Operating Aisle, Rad Protection Ops. Area, and Stack Monitor Room.

Air Supply #2 - This system consists of filtered and heated air to the Receiving Area. No AC is provided for this area.

Air Supply #3 - This system consists of filtered and heated air to the Load-Out/Truck Bay. No AC is provided for this area.

Air Supply #4 - This system consists of recirculated air to the office area with sufficient make-up outside air to slightly pressurize the area for positive contamination exclusion. Air is filtered, heated, and cooled.

Air-conditioned recirculated air streams are furnished to provide heating or cooling at strategic locations within the Contact Maintenance Area. Cooling is provided for operating aisles, and areas where personnel would suit-up for radiological control. Cooling is provided in the office areas for personnel comfort.

Heat is available for all areas for year-round personnel comfort as may be required. Heating is provided by natural gas.

The distributed ventilation systems are discussed in SDD R08

5.8.2 Contaminated Area Ventilation System (Exhaust)

The Remote Handled Waste Facility (RHWF) requires a ventilation system for the contaminated and potentially contaminated areas. Since high levels of loose contamination may result during unpackaging, segmenting or handling of the waste to be processed in this facility, special attention is required for containment, penetrations and access design and means for air filtration.

The Contaminated Area Ventilation System (Exhaust System), which provides filter exhaust for all contaminated areas is discussed in SDD R08. The contaminated areas include the Buffer Cell, Work Cell, Contact Maintenance Areas, and Waste Packaging Area.

In order to assure containment of the expected high levels of contamination in the Work Cell, an operating design pressure, consistent with the guidelines of ERDA 76-21 is provided. A Work Cell exhaust flow rate is required to pull a sufficient volume of air from the Work Cell to maintain the negative pressure. This flow rate is dictated primarily by in-leakage due to clearances around equipment doors, crane rails and waste packaging area closures between the Work Cell and the Contact Maintenance Area, Waste Packaging Area, and the Buffer Cell. (Reference SDD R08).

5.9 Civil / Structures

5.9.1 General Civil / Structures

The Remote Handled Waste Facility (RHWF) Building is a standalone, three (3) zone facility designed and constructed to process and package radioactive wastes. It encloses and supports the Remote Processing, Waste Packaging and other interfacing systems. More details are provided in SDD R09.

The RHWF is a reinforced concrete Main Building with a Receiving Area extension at the north end, an adjoining Load Out/Truck Bay on the east side, and an adjoining Office Building at the south end which are constructed of structural steel framing with insulated siding/roofing and are pre-engineered buildings. Thickness of the concrete elements is selected to satisfy shielding requirements in addition to structural considerations. Personnel and equipment access are provided through personnel and roll-up doors. Design of the structures incorporate resistance to the loading anticipated during normal operation. Selection of materials is in accordance with guidance provided in the New York State Energy Conservation Code (NYSECC). Structures and components that are required to confine radioactive material that could be hazardous to the public or site personnel, are designed to withstand the effects of postulated natural hazards without loss of their capability to perform their safety function(s) or prevent the release of radioactivity. (Reference SDD R09).

Adequate access roads and driveways to and from the RHWF will be provided. The RHWF access road from the CPC-WSA will be designed for heavy haul loads to be delivered to the Receiving Area roll-up doors (north and west sides). There will be a limited number of heavy loads (approximately 35) from the CPC-WSA that will be transported by a customized shielded fork lift that will have a drive axle load of approximately 93,500 lb. With a tire footprint of 780 sq. in., this translates to a ground pressure of approximately 120 psi.

5.9.2 Platforms and Ladders

5.9.2.1 Introduction

Platforms and ladders are provided for maintenance of the Receiving Area and Work Cell overhead traveling cranes and their trolleys. In addition, ladder access is provided as required to all roof areas. All platforms, ladders, and handrails are designed in accordance with OSHA requirements.

5.9.2.2 Summary

Maintenance platforms with access ladders are provided at the following locations:

1) Contact Maintenance Area upper and lower levels with one intermediate level platforms in between for maintenance of the Work Cell overhead crane
2) Receiving Area for overhead crane maintenance

5.10 Electrical Distribution System

The function of the Electrical Distribution System (System R10) is to provide the required motive and control power for the operation of various system loads. The Electrical Distribution System provides 480V, 208V, 240V, and 120V AC power for the operation of various equipment such as doors, cranes, compressors, fans, hoists, tools, radiation monitors, friskers, lighting and cameras. The system also provides an uninterrupted power supply (UPS) up to 30 minutes to service critical electrical loads that must remain functional for certain duration during loss of power.

The Electrical Distribution system is equipped with two Motor Control Centers (MCC's). One MCC will distribute power to the essential loads while the other MCC will distribute power to the non-essential loads. The system will receive power from the two sources at WVNS site. The source for the MCC with essential loads will be from PVS MCC-A, which is backed by 750 KVA standby Diesel Generator 50-P-1. The source for the MCC with non-essential loads will be from 480V AC Outdoor Substation 30-US-2, Switchgear B. The two MCC's will have manual bus tie to maintain power supply for essential loads.

The UPS system has an inverter, battery charger, batteries, distribution panel and a transformer.

The 208/120V- and 240V-power supply will be from distribution transformers. The power supply to these transformers will be from the two MCC's. (Reference SDD R10)

5.11 Compressed Air Supply System

The compressed air system consists of two redundant air compressor systems each consisting of an air compressor, filter, dryer, and receiver unit with distribution piping that provides utility air and instrument air for use within the facility. The compressed air system will also supply breathing air needed in the potentially contaminated areas of the Buffer Cell and the Crane Maintenance Area, and Waste Packaging Area where manned entry is allowed for contact operations. Connections for breathing air will be outside the airlock for these areas. (Reference SDD R11)

5.12 Demineralized / or Utility Water Distribution

Demineralized water or utility water is supplied to the RHWF for washdown and decontamination purposes. Primary decontamination capabilities are provided in the Work Cell, Buffer Cell, and the Contact Maintenance Area. The Waste Packaging Area has penetrations that may be utilized for washdown of a waste container or the area itself, if necessary. (Reference SDD R12 for Demineralized Water Distribution.)

5.13 Fire Protection System

The fire protection system will serve to protect portions of the ex-cell area in the Remote Handled Waste Facility and safeguard human life in the event of a fire. The system basically consists of the fire suppression system, which provides the means for extinguishing and/or control of fire in areas designated to be protected by same; and the fire detection system, which senses the presence of smoke or fire in areas and activates and communicates alarms and control measures accordingly. (Reference SDD R13).

5.13.1 Fire Suppression System

A discussion of the fire suppression system follows:

Design guidelines include the following:

1) DOE Order No. 420.1 – Facility Safety
2) NFPA 801 – Standard for Facilities Handling Radioactive Materials
3) NFPA 13 and 24
4) WVDP – 177 – Fire Protection Program, Chapter 5

The Fire Suppression System is a wet type and water will be supplied from the main plant loop. The suppression system distribution pressure will be supplied by the Main Plant fire pump system pressure and will be sufficient for facility operation.

The fire system types and areas and rates of coverage are chosen based on the codes and standards and the provision of a Fire Hazard Analysis for each area of the Facility. Hydraulic calculations are performed as required. Piping and supports are provided. (Reference SDD R13.)

5.13.2 Fire Detection System

A fire alarm and detection system will be installed to provide early detection of a fire condition and provide audible and visual indicators to alert occupants for evacuation. Design guidelines include NFPA 101.

The fire alarm and detection system will be a fully addressable notification of all devices including smoke detectors, heat detectors, manual pull station, and interface devices. Interface devices shall be used in conjunction with sprinkler flow switches, valve tampers, and other related systems.

The system will also be capable of incorporating programmable output relays for the control of ancillary functions such as HVAC dampers, blower controls, and Keltron alarm activations. Control of HVAC dampers and blowers is through the Programmable Logic Control System (PLC) described in Section 5.14.

The systems make and model is equivalent to what is used in the Vitrification facility and 01/14/Building (i.e., Siemens MXL Advance Protection System).

A Keltron alarm Data Gathering Panel (DGP) will be incorporated into the design to transmit fire alarm and sprinkler alarm signals to the Main Gate guardhouse. A remote annunciator panel will also be located in the RHWF. (Reference SDD R13.)

5.14 Control System

5.14.1 Summary

A Programmable Logic Control System (PLC) is provided to operate and / or monitor the majority of RHWF systems. Local controls will be provided as appropriate. Components with proprietary control systems such as the powered dexterous manipulators (PDM's) will be retained within the manufacturers control panels.

The control system is a combination of specially designed panels using commercially available components in conjunction with commercially available proprietary control panels. A supervisory monitoring station will be located in the office area of the facility. This station will contain an annunciator display and a CCTV.

The details of the Control System are provided in SDD R14.

5.15 Security System

Access Control:

The Access Control System shall consist of a Proximity Card Reader, Request to Exit Device, Electrical Door Strike and Door Status Monitor Contract.

All peripheral devices will be controlled by a Simplex [Site Standard] Access Terminal Controller [TC]. This T.C. is powered from standard 110 Volt AC power, with built in standby battery power.

The T.C. will be networked to the Simplex NT 3400 Access Control Unit located at the Main guardhouse via fiber optic cable.

CCTV:

Closed circuit television cameras will be color, with outdoor pan, tilt, and zoom housings as supplied by Simplex, [Site Standard].

The complete units will be provided, located on the outside of the RHWF.

All cameras will be monitored and controlled at the Main guardhouse via fiber optic cable.

The Guardhouse shall have a dedicated 20" color monitor with multiplex units for all cameras at the RHWF.

The details of the Security System are provided in SDD R15.

5.16 Communications

A telephone system will be installed within RHWF. This will be an extension of the existing WVDP system using the same equipment, or equal, and tied into a local network. SDD R16 provides the design description for this system as well as the required interfacing with the existing system and plant personnel.

6.0 MAINTENANCE AND RECOVERY OPERATIONS

6.1 Introduction

This section describes the maintenance and recovery operations identified as part of the overall RHWF design, construction, and operation. The purpose is to provide information to operation and maintenance personnel to facilitate their planning. The objectives include; 1) identification of options for handling failed equipment, 2) identification of maintenance requirements, and 3) integration of the equipment and facilities needed into the overall facility design concept.

Two types of maintenance activities will be required for this facility. The first type of maintenance activity is Planned or Routine Maintenance. Planned or Routine Maintenance tasks are those activities, which are performed on a predetermined schedule. Tasks such as general inspections and replacement of expendable components fall into this category. The purpose of this type of maintenance is to minimize the potential of equipment failure during process operations.

The second type of maintenance activities is Unanticipated Maintenance. Unanticipated Maintenance tasks are those activities which are performed to repair or replace a component which has failed unexpectedly during process operations.

Only general overall maintenance and recovery operations for the facility are included here. Individual systems also identify general maintenance and recovery operations for each system. Both of these sources and vendor-supplied information will be used to prepare the operations and maintenance manual near the completion of construction (By WVNS).

6.2 Discussion

Maintenance operations may be either by remote maintenance or by hands-on or manual maintenance. The majority of maintenance activities for this facility will be hands-on maintenance. This approach was taken because the added features needed for complex untested equipment and the added maintenance man-hours required to perform complex remote/robotic maintenance activities are not justified. In addition, because the duty cycle associated with the operation of the equipment in this facility is minimal, it is unlikely that component wear will exceed operating parameters. This, along with the low material degradation rate due to radiation, will result in minimal component failures over the life of the facility. As a result, manual maintenance will be the most cost-effective approach and has been selected as the primary method for maintaining the equipment in this facility. However, due to the nature of this facility (restricted access into the Work Cell) some maintenance activities will need to be done by remote/robotic means. Therefore, the following approach has been identified:

- All equipment within the facility except those located in the Work Cell and the HEPA filters will be suitable for manual (hands-on) maintenance.
- In-Cell filters in the Work Cell are designed for removal, replacement, and disposal operations from outside the Work Cell using remote techniques.
- Equipment located in the Work Cell will be designed to be either transported to the Contact Maintenance Area intact or designed as modules which can be removed by remote/robotic means and transported to the Contact Maintenance Area. Repair/replacement of components will be performed manually (hands-on) in the Contact Maintenance Area and the component returned to service remotely. However

equipment which can be remotely maintained cost effectively in the Work Cell may use this as an option. Remote maintenance, if cost effective will be a first option.

- A maintenance station for maintenance work will be located considering the feasible use of the MSM located at the Sample Packaging and Screening Room.

This will provide the most cost-effective approach for maintaining the facility by minimizing the design complexity of the equipment and complexity of the maintenance operations. In addition, it will provide the maximum protection for the maintenance personnel. The need to access the highly contaminated areas of the facility will only be required for special cases.

6.2.1 Planned/Routine Maintenance

The planned maintenance activities for the facility will be kept to a minimum. Except for certain areas and equipment the radiation levels outside the work cell are low and therefore have minimal effect on the life of the non-metallic components. Specific consideration of radiation effects were considered for the PDM, shield door drives, crane drives and CCTV's. Sealed bearings, motors, reducers and other moving parts are used to reduce contamination from wash-down operations and airborne contaminants. The duty cycle associated with the processing equipment is low. The degradation of components due to radiation and wear (with the exception of cutting tools) are low and do not warrant routine maintenance . In most cases it will be a more cost-effective approach to replace components as they fail. However, several critical routine maintenance operations have been identified for the facility. These routine operations include routine inspections of the bridge and jib cranes including testing of the end of travel limit switches, calibration of the radiation monitors, scales, control system gauges, and radiation survey detectors per manufactures recommendations, and replacement of the in-cell filters. The life of the in-cell filters could be extended if protective covers are placed over the filters to minimize the effects of wash-down operations.

Inspection of the bridge cranes will be performed visually. The clean crane will be positioned at its end of travel limit in the Receiving Area adjacent to the maintenance platform and the contaminated cranes will be positioned in the Contact Maintenance Area at their end of travel.

The contaminated cranes will be washed down prior to entering the Contact Maintenance Area. A row of spray nozzles at ceiling level is incorporated onto the Work Cell to permit wash down of the top surface of the cranes.

Once in position in the Contact Maintenance Area, maintenance personnel will perform as a minimum, the following visual inspections:

1) Inspect the cables as they are lowered over their full range of travel for other activities to be performed on cranes:
    - Ensuring free uninhibited feed-out of the cable, tube sections (contaminated crane) and crane hooks
    - Lubrication
    - Looking for broken cable braids
    - Looking for kinks in the cable
    - Looking for misalignment of the cable on the drum
2) Inspect electrical cable management system as the bridge is driven into position for inspection for:
    - Ensuring free uninhibited feed-out of the electrical cable

- Looking for broken electrical cables and abraded or damaged insulation
- Looking for kinks in the electrical cable
- Looking for misalignment of the electrical cable on the cable reels

3) General inspection of the condition of the bridge and trolley structure and end trucks
4) End of travel limit switches will be tested by manually closing them to verify operation
5) The jib crane will need to undergo similar inspections as identified for the bridge cranes above. However, inspection of the jib crane may be by CCTV system. In addition, means will be provided to remove the jib crane from the Work Cell and perform inspections or repairs in the Contact Maintenance Area. This may require modularization of the jib crane components to break it down into parts that would pass through the Contact Maintenance Area shield door.

As stated above, calibration of the radiation monitors, scales, control system gauges, and radiation survey detectors will need to be done routinely per manufacturer's recommendations.

Replacement of the In-Cell filters will be carried out by remote operations external to the Work Cell. Replacement of filters may be decided during operation based upon differential pressure, radiation levels and/or time. Differential pressure measurements will be between the In-Cell filters and the Air Cleaning Unit.

6.2.2 Unanticipated Maintenance

As stated above the approach taken for maintaining the equipment is to repair/replace components as they fail. This does not present a problem for any of the equipment located outside of the Work Cell. This equipment can be repaired manually (hands on) in place as required. Equipment located in the Work Cell can not be directly accessed for manual repairs. As a result this equipment (equipment located in the Work Cell) is designed for recovery operations. Three approaches are proposed for maintaining the equipment in the Work Cell. The first approach is to replace the failed component by remote/robotic means. If equipment can be maintained remotely this is a second approach, which may be utilized. The third approach, which is the primary method for maintenance, is to spray down the equipment and then move the equipment into the Contact Maintenance Area and repair it manually. Based on these approaches the following procedure are recommended for maintenance of equipment in the Work Cell:

1) Bridge Cranes - All repairs to the work cell bridge cranes will be done manually in the Contact Maintenance Area. The following features have been incorporated so that the cranes can be recovered for maintenance operations
   - The Work Cell bridge cranes will be designed so that the crane can be moved into the Contact Maintenance Area.
   - The design will allow the Work Cell bridge cranes to be properly positioned and driven into the Contact Maintenance Area if a primary trolley drive component fails. A towing latch will be provided so that the 30 Ton bridge crane can retrieve the dual telescoping mast bridge crane.
   - The access path to the Contact Maintenance Area has been configured to permit the bridge cranes to enter the Contact Maintenance Area with the 3 Ton mast lowered to it's full length of travel. The other 3 Ton capacity telescoping mast is designed with redundant capability to fully retract and pass over the work cell/CMA wall.

2) Jib Crane - Repairs to the jib crane will be performed manually in the Contact Maintenance Area. The entire jib crane can be moved into Contact Maintenance Area where maintenance will be similar to the bridge crane, and where the jib crane can be tested.

3) Power Dexterous Manipulators (PDMs) - All PDMs are configured so they can be moved to the Contact Maintenance Area for manual (hands-on) maintenance operations

4) Waste Container Load-in Powered Rollers - The load-in rollers are configured to be simply supported so that they can be easily removed using a crane hook. Once removed, they will be disposed of in a LLW box and a new conveyor will be installed in place of the failed one. Motor drives should be replaceable as a separate module.

5) Miscellaneous Equipment - In-cell cameras, sensors/monitors, and scales are designed to be remotely removed and replaced. The failed equipment will be disposed of in a LLW box and a new one installed in its place.

6) Lights - An in-cell lighting system incorporates remotely replaceable lights.

7) Storage Racks/Work Shelves - The storage racks and work shelves are designed to be simply supported so that they can be replaced with a new one in the highly unlikely event of a structural failure. Any failed structure will be segmented and disposed of into the proper drum/box container.

APPENDIX A

REMOTE HANDLED WASTE FACILITY OVERALL PLANT DESIGN DESCRIPTION

RHWF STRUCTURES, SYSTEMS AND COMPONENTS (SSC) CLASSIFICATION DOCUMENT

1.0 PURPOSE

The purpose of this document is to establish the safety and quality design level classification of the structures, systems, and components (SSCs) for the Remote Handled Waste Facility (RHWF).

2.0 SCOPE

The scope of this appendix is limited to the design of the structures, systems and components of the Remote Handled Waste Facility.

The DOE and West Valley site upper tier documents have been utilized as the basis for establishing the safety classifications and their quality assurance levels. The recently established upper tier document (DOE Order 420.1) has modified previous classification schemes. This new upper tier document essentially utilizes the same basic elements of safety, which requires the classification of the SSCs according to consideration of health and safety risks.

The upper tier documents, which govern the assignment of safety classifications, QAL and corresponding requirements, and the Earthquake Resistant Design Requirement Classification and Categorization, are:

WVDP – 204 Scope of Work (Including the Design Criteria Document)

DOE Order 420.1 Facility Safety

WVNS Quality Management QM-2

WVNS Quality Management QM-3

These upper tier documents were identified during the bidding process and formed the basis of the proposal to West Valley Nuclear Services. These documents form the basis of the specific classification and requirements established within this appendix.

The PSAR performed an evaluation and analysis of the potential hazards associated with the RHWF. This PSAR information and the upper tier governing documents have been utilized to evaluate the safety classifications and Quality Assurance Levels of the SSCs in the RHWF.

The portions of the upper tier documents, which are relevant to the classification of SCC's and the PSAR, are provided in Section 3.0 and Attachment A to this Appendix A. This central location of the relevant requirements helps to focus on the establishment of the classification of the SSCs. Section 4, including Table 2 provides a summary of the classifications of the SSCs based upon each of the upper tier documents. In addition, Table 2 provides the design codes, which will be used, for the SSCs of the RHWF.

Although the primary purpose of this Appendix is to establish a firm foundation for the design to proceed, this Appendix also provides the first step in assurance that the SOW and the criteria in Section 8.0 of the Design Criteria are included in the design of the RHWF.

3.0 CLASSIFICATIONS AND CORRESPONDING REQUIREMENTS

3.1 Contract Provisions (Reference 5.1)

The Subcontractor shall implement a Quality Assurance (QA) program that meets all basic and supplemental requirements and the guidelines shown in the appendices of ANSI/ASME NQA-1 (1989 including addenda 1a and 1b, or later). The application of these QA program elements shall use a graded approach based on system design and function, facility/system/equipment safety requirements, complexity of the system or task, cost and schedule impacts, environmental impacts, and other unique requirements determined by the subcontractor.

3.2 Design Criteria Requirements (Reference 5.2)

QA Program requirements for the Remote-Handled Waste Facility are defined in WVDP-111, WVNS Quality Assurance Program. This QA program is based on and satisfies the requirements of 10 CFR 830.120 (the QA Rule) and DOE Order 414.1. The WVNS policies relative to the implementation of this Quality Assurance Program are delineated in WVDP-002, Quality Management Manual, which is based on meeting the requirements of ASME NQA-1 and DOE/RW-0333P.

WVDP-204, "Quality List" (Q-list), has been revised to list the classification and quality levels for the RHWF and its major subsystems, included in Part F of Attachment A to the document.

Although there is a difference in quality levels for some Structures, Systems and Components between the OPDD and the WVDP-204, procurement specification, inspection and testing specified in project engineering procedures result in overall quality levels that align with WVDP-204.

The safety class, as identified in Section 3.4, drives the quality level, which in turn establishes the programmatic implementation of the Quality Assurance Program, which is based on the 18 criteria of ASME NQA-1 and all applicable supplements.

3.3 Determination of Safety Significance (Reference 5.3)

DOE has recently established an upper tier document, (DOE Order 420.1) which introduces a revised classification scheme. This upper tier document, although new, essentially utilizes the same basic elements of safety, which require the classification of systems, structures, and components according to considerations of health and safety risks. The new upper tier document (DOE Order 420.1) identifies requirements based upon whether systems, structures, and components are 'safety significant'. The requirements of DOE Order 420.1,which are applicable to the Remote Handled Waste Facility, are provided in Attachment A to this Appendix.

3.4 Determination of Safety Class (Reference 5.4)

Prior to the establishment of DOE Order 420.1 WVNS had utilized other upper tier DOE Orders to establish the safety classification system. This WVNS safety classification system has been established in WVNS QM3 and is provided here for easy reference. The relevant portions are as follows:

A WVNS safety classification system has been established for classifying activities or processes, and structures, systems, and components (SSC) where failure, error, or inadequacy could cause undesirable environmental, health, or safety risks. The classification system consists of four levels of classification: Safety Class A, B, C, and N. (WVNS currently does not have any safety class A items). Classification includes non-nuclear and nuclear materials. In addition to the risks from hazardous materials, classification must include recognition of typical industrial safety risks associated with the design, construction and decommissioning of plant facilities and processes.

A key element in the application of safety classes is that the SSC or activity be a part of, or directly involved with a plant processing facility. Laboratory areas, including operational or experimental areas are process related. Safety class applies to the plants, laboratories, maintenance, special processes (welding, lifting, and handling, pressurized fluids), and transportation of hazardous waste or material. Except for unusual situations, safety classes will not be applied to routine non-process activities, or SSC, for example; office activities, office structures, lunchrooms, normal transportation items or activities, or normal maintenance and machine shop activities. Transportation and maintenance activities involving seismic equipment, special processes, pressurized fluids, process equipment, and controlled hoisting and rigging are not considered as "normal" and require safety classification.

3.4.1 Safety Class A

This class is applied to plant or facility activities and SSCs where the risk of failure, error, inadequacy, or loss of control is categorized as a High Hazard, (Hazard Category 1) as defined in WV-365. Criteria and examples for categorization include the following:

A. General Criteria

The activity or failure of the SSC could result in:

1. Impact to large number of persons on-site or off-site.
2. More than five (5) on-site fatalities.
3. One (1) or more off-site fatalities.
4. Off-site nonradiological effluents causing long term environmental damage.

B. Specific Hazardous Material Thresholds:

Radiological: Off-site Effective Dose Equivalent (EDE) in excess of 25 REM.

3.4.2 Safety Class B

This class is applied to plant or facility activities and SSCs where the risk of failure, error, inadequacy, or loss of control is categorized as Moderate Hazard (Hazard Category 2) as defined in WV-365. Criteria and examples for categorization include the following:

A. General Criteria

The activity or failure of the SSC:

1. Could result in serious injuries to more than five (5) but not more than ten (10) people, and/ or up to five (5) fatalities on-site.
2. Could result in up to five (5) off-site serious injuries.
3. Any non-radiological airborne release at or above WVDP NYSDEC air permit limits, any non-radiological liquid, liquid effluent at or above WVDP NYSCDEC SPDES limits, or any non-radiological spill/release that is

contained or cannot be remediated immediately and/or impacts the public or off-site environment.

B. Specific Hazardous Material Thresholds

Radiological: Off-site EDE in excess of 0.5 REM.

On-site EDE in excess of 5 REM.

Non-radiological: On-site airborne release greater than or equal to 1 Immediate Danger to Life and Health (IDLH).

3.4.3 Safety Class C

This class is applied to plant process-related or plant facility operational activities and SSCs where the risk of failure, error, inadequacy, or loss of control is categorized as Low Hazard (Hazard Category 3) as defined in WV–365, and the equivalent of hazards routinely accepted by the workers or the public. Criteria and examples for categorization include the following:

A. General Criteria

The activity or failure of the SSC could result in:

1. Injury to not more than five (5) personnel within the plant or on-site.
2. No increased risk to the public from hazards not routinely accepted by the public.
3. Any non-radiological airborne release below WVDP NYSDEC air permit limits, any non-radiological liquid effluent below WVDP NYSDEC SPDES limits, or any non-radiological spill/release that is contained or can be remediated immediately and/or does not impact the public or off-site environment.

B. Specific Hazardous Material Thresholds

Radiological: Off-site and on-site non-dosimetry qualified personnel EDE in excess of 0.01 REM.

On-site EDE does not exceed 3 REM

Nonradiological: On-site airborne releases greater than 1 Short Term Exposure Limit (STEL).

3.4.4 Safety Class N

This safety class applies to non-process site activities and SSCs where the risk of failure, error, inadequacy, or loss of control is the equivalent of hazards routinely accepted by workers or the public. Criteria and examples for categorization include the following:

A. General Criteria

The activity or failure of the SSC could result in:

1. No off-site personnel injury or environmental impact.
2. No personnel injury within the plant area or on-site attributable to process operational activities.

B. Specific Hazardous Material Threshold:

Radiological:	No reportable personnel contamination or release of radioactive material.
Nonradiological:	No on-site exposure that violates an administrative health and safety limit. No on-site airborne, liquid, or solid material releases that require reporting to the DOE or regulators.

3.4.5 Safety Class Summary

Table 1 summarizes the safety designation based upon hazard categories.

3.5 Quality Level (Reference 5.5)

A quality level system has been established for application of the Quality Assurance Program (QAP) on activities affecting quality. The system has four (4) categories (Quality Level A, B, C, and N) as described in QM 2. Categorization is designated in accordance with predicted consequences of failure based upon environmental, health and safety, and programmatic impacts. Much of the criteria for determining Quality Level is similar and in some instances redundant to the criteria used for Safety Class determination. The redundancy is considered necessary and appropriate, since Safety Class is generally applied with emphasis on SSC while the Quality Level system concentrates on activities. The Quality Level system as established by QM-2 directly incorporates operational and service considerations for WVDP SSCs that are not included in Safety Class determination.

3.6 PSAR Results (Reference 5.6)

The PSAR for the RHWF (Rev 0, draft B) has provided analysis and justification for the Safety Classification of Systems, Structures, and Components with an analysis for hazard protection based upon the Conceptual Design of the RHWF. The analysis has included an evaluation of the conceptual design and the potential hazards including

- Waste and Radioactivity Confinement
- Assuring that Occupational Hazards Exposures are ALARA

The hazards identification based upon the Conceptual Design (PSAR Section 9.1.1.1) determined that neither the potential waste streams being processed in the RHWF nor operations or procedures associated with these waste streams contain significant quantities of hazardous chemicals. .

Accidents selected for further evaluation in the PSAR included:

1. Contaminated Area Ventilation System Filter Failure
2. Fire in Load Out / Truck Bay
3. Waste Container Lift Failure
4. Beyond Design Basis Natural Gas Explosion
5. Beyond Design Basis Seismic Event
6. Beyond Design Basis Criticality Accident

The PSAR analysis considered consequences of hazards, hazard events, and initiator of hazard events (Table 9.1-1 of the PSAR). Considering the consequences and frequency of postulated events a risk factor was assigned. It is noted that the risk factor associated with the RHWF design included only risk factors, 1, 2, and 3. The mitigative features for the RHWF included primarily establishing safe operational procedures. The design features, which were in the Conceptual Design and for which the PSAR has taken credit was confinement barriers to reduce radioactive dispersion. Thus, the structural integrity of the shield walls for confinement is a factor to maintain design requirements necessary for the PSAR.

The radiation monitoring of personnel with badges and area radiation alarms are also available to reduce the potential radiation exposure. Also fire detection alarms will be available to alert personnel of potentially hazardous conditions.

Criticality Defense in Depth

The analysis of the PSAR considered the potential configuration of fissile materials within the RHWF and its systems. Although the risk of this occurring was considered incredible.

As part of the defense in depth the only potential place for accumulation would be in the collection of waste. Therefore, design features are included which further assure criticality configurations will not occur. Therefore, the collection of waste includes a strainer/filter to remove any potential fissile material with the strainer geometry positively excluding the potential configuration of a critical arrangement. The waste in the filter will be analyzed. The tank contents will have a grab sample taken for analysis prior to the transfer of the waste tank contents to other facilities for processing.

Effective Dose Equivalents (EDE) were calculated in the PSAR for (a) failure of the RHWF in-cell filter array. This accident bounds all accidents involving a dropped container, including those inside the RHWF. The postulated simultaneous failure of all of the filters resulted in calculated maximum exposure to an offsite individual of 0.56 rem (0.0056 Sv) and the maximum receptor on-site of 0.93 rem (0.0093 Sv). These doses are below the radiological dose acceptance criteria specified in Section 9.1.3 of the PSAR for this extremely unlikely event.

For a natural gas explosion in the RHWF the maximum TEDE at the on-site evaluation point is 8.6 rem (086 Sv) while the maximum TEDE received by an off-site individual is 5.2 rem (0.052 Sv).

The Waste Container lift failure postulated is in the CPC/WSA area and is therefore not a consideration for the RHWF design including the safety and quality class determinations.

A postulated fire in the Load Out / Truck Bay Area results in a maximum exposed on-site individual is 0.51 rem (0.0051 Sv) while the maximum TEDE received by an off-site individual is 0.31 rem (0.0031 Sv).

The RHWF (WVNS-SAR-023) has determined the RHWF is consistent with site safety analysis as described in WVNS-SAR-001. Based upon this the WVNS – SAR – 023 has developed the necessary considerations for the RHWF. Thus, for this SSC classification only WVNS-SAR-023 discussions, evaluations, and results are needed. In addition WVNS-SAR-023 has considered the design criteria which were established for the RHWF (WVNSDC-071. Therefore, since the Preliminary Design is based upon these design criteria the results of the PSAR evaluation concerning the design criteria for the structures (e.g., natural loads and forces) and the design criteria for the systems (e.g., Design Criteria 6.4.2. Ventilation Requirements have specific codes referenced including

ERDA 76-21, ANSI 509, ASME AG-1 and ANSI 510) the PSAR analysis is considered complete.

It is noted that the PSAR analysis of confinement functions did not require the operation of the ventilation system to mitigate accidents, which were analyzed in section 9.2 of the PSAR.

The fire protection program and design will be consistent with the remainder of the site. Therefore, no unique features of the fire protection system are anticipated. The fire protection safety classification and quality classification will be assigned consistent with other site facilities.

PSAR Derivation of Technical Safety Requirements

There are no Design Basis Accidents that have consequences associated with them that exceed the Evaluation Guidelines established in the PSAR. Therefore, it was concluded from the PSAR analysis that there are no SSCs, which require safety class. The PSAR discussed the defense-in-depth as it pertains to the RHWF including the barriers for RHWF work protection. Thus, the barriers, which prevent radioactive leakage, could be safety significant. The safety significant structures would be the shield walls around the work cell. Penetrations through the shield walls would only marginally contribute to radiation releases and therefore need not be safety significant.

From this analysis it is concluded that the structural shield walls need to be designed to the requirements established in DOE O 420.1. The codes identified in Table 2 are considered to satisfy the safety significant requirements.

4.0 CLASSIFICATION OF SYSTEMS, STRUCTURES AND COMPONENTS

A complete listing of structures and systems, which are classified according to the basic classification scheme are described in this document and summarized in Table 2.

4.1 Summary Table of Classifications

Table 2 provides a summary of the classifications based upon upper tier documents for all structures and systems of the Remote Handled Waste Facility.

4.2 Design, Procurement, Shipping and Construction Requirements

Table 2 provides the design codes, which will be utilized, for systems, structures, and components.

For Safety Significant structures, system, and components supplied the following will apply:

a) The reinforced concrete design will comply with the requirements of ACI 318.

b) Technical specifications will establish the technical and quality requirements of the structures, systems, components, and materials.

c) Technical documents will establish the requirements for handling, storage, and shipping.

d) Construction documents will establish the requirements to be followed during construction.

Non-safety significant structures, systems and components will be procured and erected to good commercial standards. In all cases the codes identified in Table 2 will be implemented for the applicable sections of design, procurement, erection and testing. Each phase of implementation will determine the appropriate level of quality assurance to be applied. The implementing procedure that lists the Construction Quality Level (CQL) of components included in the designed systems is PEP 2.1, "Grading Application of the QA Program", which was prepared after the Design Quality Level (DQL) classifications were established by Design Engineering. PEP 2.1 is a controlled document that is assigned to all affected parties, including the Design Engineering, to ensure Design Engineering's review and concurrence with any revisions to the contents.

5.0 REFERENCES

5.1 Contract Special Provisions (RFP No. 19-094708-Q-CA; Revision 0; dated June 28, 1999

5.2 WVNS-DC-071; Revision 8; dated 06/16/2003

5.3 DOE Orders 420.1 and 435.1

5.4 West Valley Quality Management; Design Control; QM-3

5.5 West Valley Quality Management; Quality Assurance Program; QM-2

5.6 PSAR, Rev 0, Draft B

5.7 NY State Energy Conservation Code (NYSECC)

TABLE 1
SUMMARY OF CLASSES BASED ON HAZARD CATEGORIES

TYPE	SAFETY CLASS	OFF- SITE	ON – SITE
General Risk	A	One or more fatalities	More than five fatalities
	B	Five or less injuries	Five or less fatalities
	C	No injuries	Five or less injuries
	D	Routine risk	Routine risk
Radiological	A	More than 25 REM EDE	******************
	B	More than .5 REM EDE	More than 5 REM EDE
	C	More than .01 REM EDE	Less than 3 REM EDE For Dosimetry qual., more than .01 REM EDE for non-Dosimetry qual.
	N	No reportable contamination	No exposure that Violates admin. Limits.
Chemical	A	* * * * * *	* * * * * *
	B	* * * * * *	1 or more IDLH
	C	* * * * * *	1 or more STEL, but less than 1 IDLH.
	N	* * * * * *	No on-site exposure That violates admin. Limits.
Environmental	A	**Long term damage**	* * * * *
	B	Significant, transient damage	* * * * *
	C	Temporary but restorable damage	* * * * *
	N	**No damage**	* * * * *

EDE-----Effective Dose Equivalent
IDLH----Immediate Danger to Life and Health
STEL----Short Term Exposure Limit

* * * Indicates No Specific WVNS Site Requirements

TABLE 2
DESIGN CODES FOR RHWF
STRUCTURES, SYSTEMS AND COMPONENTS

STRUCTURE, SYSTEM OR COMPONENT	WVNS SAFETY CLASSIFICATION	QUALITY LEVEL DESIGN Note (1)	DESIGN CODE
R01 Remote Processing System	N	C	AISC ANSI B30.2 CMAA – 70
R02 Waste Packaging System	N	C	
R03 Shielding System	C	C	ANSI N101.6
R04 Radiation Protection System	C	C	Glove Boxes (Manufacturer's standards)
R05 Radiation Monitoring System	C	C	ANSI N13.1 NYCRR 200-250
R06 Waste Collection & Transfer System	C	C	ANSI B31.3 AWWA D100
R07 Decontamination System Wet/Dry Vacuum System	N C	C C	ANSI B31.9 ANSI B31.3 (In Work Cell Portion)
R08 HVAC Systems			
Uncontaminated Area Vent System	N	N	ASHRAE SMACNA
Contaminated Area Vent System (Cell Exhaust)	C	C	ASME -- AG-1 ASME – N509 ASME – N510 SMACNA

TABLE 2 (CONTINUED)

R09 Civil Structures			
Work Cell Buffer Cell Operating Aisle Waste Packaging Area CMA HVAC Area	C C C C C C	C C C C C C	Seismic Load based on Uniform Building Code, 1991, Zone 1 New York Sate – Manual for State Building Construction Code
R09 Civil Structures			
Balance	N	N	New York State – Manual for State Building Construction Code
R10 Electrical Distribution System	N	N	National Electric Code
UPS (Part of Electrical System)	N	N (Note 2)	National Electric Code
Lighting (Part of Electrical System)	N	N	National Electric Code
R11 Compressed Air System - Instrument Air System Breathing Air System	N N	N (Note 2) N (Note 2)	ANSI B—31.9
R12 Demineralized Water Distribution System	N	N (Note 2)	ANSI B – 31.9
R13 Fire Protection System	C	C	NFPA 801
Fire Detection System	C	C	NFPA 101
Fire Suppression System	C	C	NFPA 12, 12A, 13
R14 Controls and Instrumentation	N	N (Note 2)	ISA Standards for Raytheon products
R15 Security System	N	N	

TABLE 2 (CONTINUED)

R16 Communications System	N	N	
Potable Water	N	N	ANSI B – 31.9
Sanitary Waste	N	N	Manufacturer's Standards
Yard Interfacing – Utilities	N	N	ANSI B – 31.9
Yard Interfacing – Radioactive Liquid Lines	N	C	ANSI B31.3

Note (1): Quality levels for procurement, installation and testing phases will be established at each phase, and they may be higher than the levels identified for design. The final quality level is based on the highest level assigned to any individual phase.

Note (2): Although the table specifies Design Quality Level of N, the design process which is procedurally controlled, subject to surveillance and audits and requires more than one level of participation in preparing, checking and approvals, qualifies for designation "C", and is consistent with the classification in WVDP-204.

ATTACHMENT A

TO

APPENDIX A

REMOTE HANDLED WASTE FACILITY (RHWF) OVERALL PLANT DESIGN DESCRIPTION

APPLICABLE REQUIREMENTS OF DOE 0 420.1 AND/OR DOE C 420.1

A.0 INTRODUCTION

Each section of DOE Order 0420.1 has specific requirements, and where appropriate schedules for implementing requirements and specific exemptions, which are provided in the following corresponding sections. In complying with the provisions of this Order, determinations regarding the acceptability of design should include comparison with existing safety basis information,. All new construction shall, as a minimum, conform to the Model Building Codes applicable for the state or region, supplemented with additional safety requirements associated with the hazards in the facility in a graded manner.

Guidance requirements associated with this Order are not mandatory requirements. The guidance provided in implementation guides and standards referenced therein are acceptable methods to satisfy the requirements of this Order. Alternative methods that satisfy the requirements of this Order are also acceptable. Any alternative implementation method selected must be justified to ensure that an adequate level of safety commensurate with the identified hazards is achieved.

Relevant Section numbers of DOE O 420.1 are cited below:

A.1 NUCLEAR AND EXPLOSIVES SAFETY DESIGN CRITERIA

Nuclear Safety

The objectives of section A.1 (Section 4.1 of DOE O420.1) for nuclear safety are to ensure that Department of Energy (DOE) non-reactor nuclear facilities are designed and constructed so as to assure adequate protection for the public, workers, and the environment from nuclear hazards. The requirements of this section apply to the activities of design and construction of new Hazard Category 1, 2, and 3 DOE non- reactor nuclear facilities and to the design and construction of modification to existing DOE Hazard Category 1, 2, and 3 non-reactor nuclear facilities when the proposed modification significantly degrades the approved safety basis for the facility.

Modifications to facility design and construction during the design and construction phase shall conform to the requirements for new facilities. Section 4.1 does not apply to the decision process to modify a facility, except to serve as a standard of comparison for safety requirements. Activities associated with facility deactivation at end of life are exempt if justified by a safety analysis.

A.1.1 Nuclear Safety

A.1.1.1 General Requirements

Detailed application of these requirements shall be guided by safety analyses that establish the identification and functions of safety (safety class and safety significant) Structures, Systems, and Components (SSCs) for a facility and establish the significance to safety of functions performed by those SSCs. Safety analyses shall consider facility hazards, natural phenomena hazards, and external man-induced hazards. Factors such as proximity to nearby facilities such as airports, pipelines, and barge traffic peculiar to the site shall be considered. A safety analysis shall be performed at the earliest practical point in conceptual or preliminary design, so that required functional attributes of safety SSCs can be specified in the detailed design. Safety analyses shall be performed in accordance with Safety Analysis Report (SAR) guidance for safety analysis, as described in DOE guidance documents.

Note: WVNS has developed PSAR to existing procedures.

A.1.1.2 Design Requirements

Non-reactor nuclear facilities shall be designed with the objective of providing multiple layers of protection to prevent or mitigate the unintended release of radioactive materials to the environment. Defense in depth shall include: siting, minimization of material at risk, the use of conservative design margins and quality assurance; the use of successive physical barriers for protection against the release of radioactivity; the provision of multiple means to ensure critical safety functions (those basic safety functions needed to control the processes, maintain them in a safe state, and to confine and mitigate radioactivity associated with the potential for accidents with significant public radiological impact); the use of equipment and administrative controls which restrict deviations from normal operations and provide for recovery from accidents to achieve a safe condition; means to monitor accident releases required for emergency responses; and the provision of emergency plans for minimizing the effects of an accident.

Facilities shall be sited and designed in such a manner that gives adequate protection for the health and safety of the public and for workers, including those at adjacent facilities, from the effects of potential facility accidents involving the release of radioactive materials.

All nuclear facilities with uncontained radioactive materials (as opposed to material contained within drums, grout, and vitrified materials) shall have means to confine them. Such confinement will act to minimize the spread of radioactive materials and the release of radioactive materials in facility effluents during normal operations and potential accidents. For a specific nuclear facility, the number and arrangement of confinement barriers and their required characteristics shall be determined on a case-by-case basis. Factors that shall be considered in confinement system design shall include type, quantity, form, and conditions for dispersing the material. Engineering evaluations, trade-offs, and experience shall be used to develop practical designs that achieve confinement system objectives. The adequacy of confinement systems to effectively perform the required functions shall be documented and accepted through the Safety Analysis Report.

Facilities shall be designed to facilitate safe deactivation, decommissioning and decontamination at end of life.

Facilities shall be designed to facilitate inspections, testing, maintenance, and repair and replacement of safety SSCs as part of an overall reliability, availability, and maintainability program. The objective is that the facility can be maintained in a safe state, including during these operations and in keeping with the as low as is reasonably achievable (ALARA) principle for occupational radiation exposure.

Facilities shall be designed to keep occupational radiation exposure within statutory limits and incorporate ALARA principles in design, including design provisions to facilitate decontamination during the operational period.

Facility process systems shall be designed to minimize the production of wastes and minimize the mixing of radioactive and non-radioactive wastes.

Safety SSCs identified in accordance with this section shall, commensurate with the importance of the safety functions performed, be designed: (1) so that they can perform their safety functions when called upon to operation, and (2) under a quality assurance program that satisfies 10 CFR 830.120.

Facility safety class electrical systems shall be designed to the basic approach outlined in Section 5.2.3 (Electrical) of "Implementation Guide for Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria."

A.1.3 Implementation

An Implementation Plan describing the process that will ensure that the requirements of this section will be invoked during the design and construction shall be submitted to the DOE Cognizant Secretarial Officer or his designee in accordance with section 5. Deviations from applicable requirements shall be appropriately documented and justified.

A.2. FIRE PROTECTION

Fire protection requirements of 420.1 are applicable but without special requirements invoked by safety class or safety significant system.

A.3. NUCLEAR CRITICALITY SAFETY

DOE Elements shall ensure that a contractor responsible for a DOE non-reactor nuclear facility shall establish a nuclear criticality safety program that (i) applies to fissionable materials that are produced, processed, stored, transferred, disposed, or otherwise handled, and (ii) includes the following elements in paragraphs A.3.2 and A.3.3.

A.3.1 Objectives

The objective shall be to establish nuclear criticality safety program requirements to ensure that:

1. Criticality safety is comprehensively addressed and receives an objective review, with all identified risks reduced to acceptably low levels and management authorization of the operation is documented.
2. The public, workers, property, both government and private, the environment, and essential operations are protected from the effects of a criticality accident

A.3.2 General Requirements

Operations with fissionable materials, which pose a criticality accident hazard, shall be evaluated and documented to demonstrate that the operation will be subcritical under both normal and credible abnormal conditions. Fissionable material operations shall be conducted in such a manner that consequences to personnel and property that result from a criticality accident will be mitigated. No single credible event or failure shall result in a criticality accident having unmitigated consequences.

The nuclear criticality safety program shall be evaluated and documented and shall include:

1. Nuclear criticality safety evaluations for normal and credible abnormal conditions that document the parameters, limits, and controls required ensuring that the analyzed conditions are subcritical.
2. Implementation of limits and controls identified by the nuclear criticality safety evaluations.
3. Reviews of operations to ascertain that limits and controls are being followed and that process conditions have not been altered such that the applicability of the nuclear criticality safety evaluation has been compromised.
4. Assessment of the need for criticality accident detection devices and alarm systems, and installation of such equipment where total risk to personnel will be reduced.

A.3.3 Specific Requirements

Fissionable materials shall be produced, processed, stored, transferred, disposed, or otherwise handled in such a manner that the probability of a criticality accident is acceptably low, and, to the extent practical, all persons, all government, public, and private property, and the environment are protected from damaging effects and undue hazards that may arise from a criticality accident.

The Contractor Criticality Safety Program for non-reactor nuclear facilities shall include the following requirements:

1. Contractor Criticality Safety Programs (CCSP's) shall apply to operations involving fissionable materials that pose a criticality accident hazard. Fissionable nuclides of concern to this section are listed in Table 4.3-1. The assignment of nuclides to the three columns in Table 4.3-1 is based on typical conditions. DOE Elements shall ensure that each contractor organization shall determine which column is appropriate to the fissionable nuclides existing in its inventory, whether listed in this table or not expressly included. Specific technical information concerning differences in behavior of these nuclides relevant to their differing abilities to support a self-sustaining nuclear chain reaction may be found in ANSI/ANS-8.1-1983, R88 and ANSI/ANS-8.15- 1981,R87.

Table 4.3-1. Fissionable Nuclides of Criticality Concern

Nuclide	Nuclide	Nuclide
92U233	93Np237	91Pa231**
92U235	94Pu238	92U232**
94Pu239	94Pu240	92U234**
	94Pu241	96Cm246**
	94Pu242	98Cf250**
	95Am241	98Cf252**
	95Am242m	99Es254**
	95Am243	
	96Cm243	
	96Cm244	
	96Cm245	
	96Cm247	
	98Cf249	
	98Cf251	

* Existing in quantities and forms that lead to the major focus of nuclear criticality safety.

** Existing in isolated quantities less than potential minimum critical mass (per ANSI/ANS-8.15-1981, R87, "Nuclear Criticality Control of Special Actinide Elements").

2. The basic elements and control parameters of programs for nuclear criticality safety shall satisfy the requirements of the following American Nuclear Society's ANSI/ANS nuclear criticality safety standards identified in DOE 0 420.1

3. When recommendations of the ANSI/ANS Standards are not implemented, justification shall be documented in a manner described in the Implementation Plan.

Two ANSI/ANS recommendations shall be requirements:

ANSI/ANS-8.3-1986, paragraph 4.1.2, the second sentence of which becomes, for this Order, "Where alarm systems are installed, emergency plans shall be maintained."

ANSI/ANS-8.7-1975, R87, paragraph 5.2, the last sentence of which becomes, for this Order, "The effects of more significant moderation shall be evaluated."

4. For DOE application, the following sections of ANSI/ANS-8.1-1983, R88, "Nuclear Criticality Safety in Operations with Fissionable Materials outside Reactors," shall be read as follows:

(1) Application of Double Contingency (paragraph 4.2.2, Double Contingency).

Process designs shall incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. Protection shall be provided by either (i) the control of two independent process parameters (which is the preferred approach, when practical, to prevent common-mode failure), or (ii) a system of multiple controls on a single process parameter. The number of controls required upon a single controlled process parameter shall be based upon control reliability and any features that mitigate the consequences of control failure. In all cases, no single credible event or failure shall result in the potential for a criticality accident, except as referenced in the paragraph that follows.

An exception to the application of double contingency, where single contingency operations are permissible, is presented in paragraph 5.1 of ANSI/ANS-8.10- 1983,R88. This exception applies to operations with shielding and confinement (e.g., hot cells or other shielded facilities).

Double contingency shall be demonstrated by documented evaluations.

(2) Application of Geometry Control (paragraph 4.2.3, Geometry Control).

Where a significant quantity of fissionable material is being processed and criticality safety is a concern, passive engineered controls such as geometry control shall be considered as a preferred control method. Where passive engineered control is not feasible, the preferred order of controls is, active engineered controls, followed by administrative controls. The double contingency analysis shall justify the chosen controls. Full advantage may be taken of any nuclear characteristics of the process materials and equipment. All dimensions, nuclear properties, and other features upon which reliance is placed shall be documented and verified prior to beginning operations, and control shall be exercised to maintain them.

(3) Application of Definition of "Bias" (paragraph 3.3, Glossary of Terms).

The uncertainty in the bias is interpreted as a measure of both the accuracy of the calculation and the precision of the experimental data. It is assumed also to include

- The precision of the calculation if the calculation is stochastic (notwithstanding that such precision often can be made as great as desired), and
- The accuracy of the experimental data if the experiment is a mock-up of a referenced system. Deterministic computer calculations are assumed to have very high precision, or should be made to have very high precision. Stochastic computer calculations should be forced to have appropriately high precision. An experiment that is not a mock-up is exactly accurate by definition.

A.3.4 Criticality Control

Some of the material being processed in the RHWR will contain small amounts of fissile material. Provisions for sampling and analysis of the received waste material, for more detailed fissile material characterization, are provided as part of the RHWF. This material can be processed in a critically safe manner in the RHWF.

Within the RHWR there are four areas of potential concern for criticality. These areas are as follows:

- Reconfiguration of the material during size reduction
- Waste package liner filling operations
- Storage racks arrangement and accident effects on arrangement in case of fire, flood, earthquake or other natural calamities
- Waste collection of accumulation of loose fissile material, by vacuuming or decon by demineralized water washdown.

Each of the four areas of potential concern are addressed individually, and in considerable detail in SDD R04 – Radiation Protection System, which demonstrates that a criticality accident in the RHWF is not credible. Based on this, nuclear criticality dosimeters or criticality accident alarm systems are not considered to be required in the RHWF.

A.4 NATURAL PHENOMENA HAZARDS MITIGATION

The objectives of this section are to ensure that all DOE facilities are designed, constructed, and operated so that the general public, workers, and the environment are protected from the impact of Natural Phenomena Hazards (NPHs). The provisions of this section apply to DOE sites and facilities. The provisions of this section cover all natural phenomena hazards such as seismic, wind, flood, and lightning. Where no specific requirements are specified, model building codes or national consensus industry standards shall be used.

A.4.1 General Requirements

For hazardous facilities, safety analyses shall include the ability of Systems, Structures, Components (SSCs) and personnel to perform their intended safety functions under the effects of natural phenomena.

A.4.2 Natural Phenomena Mitigation Design Requirements

Systems, structures and components shall be designed, constructed and operated to withstand the effects of natural phenomena as necessary to ensure the confinement of hazardous material, the operation of essential facilities, the protection of government property, and the protection of life safety for occupants of DOE buildings. The design process shall consider potential damage and failure of systems, structures and components due to both direct and indirect natural phenomena effects, including common cause effects and interactions from failures of other systems, structures and components. Furthermore, the seismic requirements of Executive Order 12699 shall be addressed.

Systems, structures and components for new DOE facilities, and additions or major modifications to existing systems, structures and components shall be designed, constructed and operated to meet the requirements in the previous paragraph. Any additions and modifications to existing DOE facilities shall not degrade the performance of existing systems, structures and components to the extent that the objectives in this Section cannot be achieved under the effects of natural phenomena.

A.4.3 Natural Phenomena Hazards Assessment

The design and evaluation of facilities to withstand natural phenomena shall be based on an assessment of the likelihood of future natural phenomena occurrences. The natural phenomena hazards assessment shall be conducted commensurate with a graded approach and commensurate with the potential hazard of the facility.

For new Sites; natural phenomena hazards assessment shall be conducted commensurate with a graded approach to the facility. Site planning shall consider the consequences of all types of natural phenomena hazards.

For existing Sites; if there are significant changes in natural phenomena hazards assessment methodology or site-specific information, the natural phenomena hazards assessments shall be reviewed and shall be updated, as necessary. A review of the natural phenomena hazards assessment shall be conducted at least every 10 years. The review shall include recommendations to DOE on the need for updating the existing natural phenomena hazard assessments based on identification of any significant changes in methods or data.

A.4.4 Natural Phenomena Detection

Facilities or sites with hazardous materials shall have instrumentation or other means to detect and record the occurrence and severity of seismic events.

A.4.5 Post-Natural Phenomena Procedures

Facilities or sites with hazardous materials shall have procedures that include, inspecting the facility for damage caused by severe natural phenomena, and placing the facility into a safe configuration when such damage has occurred.

APPENDIX B

REMOTE HANDLED WASTE FACILITY OVERALL PLANT DESIGN DESCRIPTION

DESIGN CHECKLISTS

For each design description document prepared the Project Manager will decide upon which checklist(s) need to be used in the review of the design document. The Project Manager will also decide who is to do the review. For example, the General Arrangement Drawings will utilize the ALARA checklist and the person assigned by the Project Manager will be the ALARA engineer. As another example the Piping Drawings Checklist will be assigned to either the lead mechanical engineer or a senior level mechanical designer. The contents of the checklists will be considered in the preparation of the design documents as applicable, however, the checklists do not have to be filled out, nor are they required to be included with the design documents.

Specific checklists included with this OPDD are:

1. HUMAN FACTORS
2. CLEANLINESS
3. REMOTE HANDLING AND MAINTENANCE
4. OPERATOR FEEDBACK & DESIRES

Other checklists include:

1. ALARA (SDD R04)
2. Piping (SDD R06)
3. Electrical (SDD R10)

The major reasons for the checklists are to provide awareness of the elements of a good design and to ensure that the design criteria requirements are considered and met in the design.

REMOTE HANDLED WASTE FACILITY
DESIGN CRITERIA CHECKLIST
4.1.5 HUMAN FACTORS ENGINEERING REQUIREMENTS

The design engineer while preparing a document shall consider Human Factors Engineering Requirements. The intent of the following checklist is to provide assurance that adequate consideration has been given to the facility design considering Human Factors Engineering Requirements. The overall intent is for the facility to be designed to be comfortable and natural for personnel to operate and maintain. Human factors include consideration of positioning equipment, switches, valves, and instruments from both an operating and a maintenance viewpoint.

To provide this, the following specific checklist is provided to guide the design engineer in considering the following:

DESIGN CRITERIA STATEMENT (Ref WVNS – DC – 071)	INFORMATION Supplied by Engineer	DISCIPLINE / ENGINEER
4.1.5.A Instrument readouts shall be located at average eye elevation for ease of reading. The instrument controls shall be located to permit visual monitoring without drastic shifts in body position.		
4.1.5.B Equipment shall be accessible for ease of operation and maintenance.		
4.1.5.C Valves shall be properly sized and located for ease of operation without using ladders, platforms, or over extending the body beyond normal reach.		
4.1.5.D Manipulators and viewing equipment shall be properly located for ease of remote operation and maintenance.		
4.1.5.E Operators with a range of physical sizes and ability need to be accommodated.		
4.1.5.F The design should minimize operations requiring special skills and attention		
4.1.5.G Audible and visual alarms that warn operators in advance of conditions exceeding limits are to be provided		
4.1.5.H Specifics for communications SSD	Not a general design condition	
4.1.5.I System control, display devices, component arrangement, vibration, lighting, emergency lighting, ventilation, temperature, humidity, human dimensions, protective equipment, warning and annunciator systems, and maintainability shall be considered in the control station design and layout.		
4.1.5.J If equipment needs to be stored has an appropriate storage area been located in an appropriate location?		

REMOTE HANDLED WASTE FACILITY
DESIGN CRITERIA CHECKLIST
4.1.6 CLEANLINESS REQUIREMENTS

The design engineer while preparing design documents shall consider Cleanliness Requirements. The intent of the following checklist is to provide assurance that adequate consideration has been given to the facility design considering Cleanliness Requirements. The overall intent is that consideration shall be given to facility and process system cleanliness during construction and operation.

To this end, the following typical examples in the form of a checklist are provided to guide the design engineer in facility design:

DESIGN CRITERIA STATEMENT (Ref WVNS – DC – 071)	INFORMATION Supplied by Engineer	DISCIPLINE / ENGINEER
4.1.6.A Personnel access around equipment has been provided for cleaning		
4.1.6.B Areas are provided for cleaning equipment.		
4.1.6.C Temporary filters on air-cooled equipment that will be operated/tested under construction conditions when there may be abnormal amounts of dust in the air.		
4.1.6.D Connections are provided to support flushing of fluid systems		
4.1.6.E Areas are provided for storing recyclable and segregated waste. An air dryer and/or filters may be required to mitigate anticipated water/dirt in compressor air lines. If so are they provided.		

REMOTE HANDLED WASTE FACILITY
DESIGN CRITERIA CHECKLIST
4.2 REMOTE HANDLING AND MAINTENANCE

The design engineer while preparing design documents shall consider Remote Handling and Maintenance Requirements. The intent of the following checklist is to provide assurance that adequate consideration has been given to the facility design for Remote Handling and Maintenance Requirements. The overall intent is that these considerations shall be given to facility as general considerations in addition to the specific requirements which have been identified as criteria within the Design Criteria of the Remote Handled Waste Facility. It is noted that the terms used in the RHWF include (a) remote changeout, which is used to denote remote replacement, and (b) remote maintenance, which is used to denote in situ maintenance. The bridge crane, jib cranes, and PDM's are the primary components, which will be brought to the Contact Maintenance Area for contact maintenance. The majority of the remaining components inside the work cell will be either remotely maintained or remotely replaced.

To provide this, the following typical examples in the form of a checklist are provided to guide the design engineer in considering remote handling for maintenance of the facility:

DESIGN CRITERIA STATEMENT (Ref WVNS DC – 071)	INFORMATION Supplied by Engineer	DISCIPLINE / ENGINEER
4.2.1.A. Equipment (e.g., sump pumps, samplers, exhaust filters, local exhaust blowers, cutting tooling, motors, and electrical components) located in the shielded RHWF work cell will also be designed to permit remote replacement. Space shall be provided for equipment removal, with reasonable disassembly and removal of adjacent equipment.		
4.2.1.B DESIGN		
2. Operational and maintenance requirements shall be considered for remote processing equipment accessibility		
3. Work cell mechanical and electrical equipment (windows, TV, manipulators, electrical enclosures. etc.) shall be sealed or otherwise protected from solutions of water (including demineralized water).		
10. Modular equipment, components, and subsystem designs shall be used where possible to facilitate removal and replacement. Special attention shall be paid to the design of guide pins and remote fasteners.		
12. Developmental or unproven states of the art items are unacceptable unless the concept/equipment are able to be proven by remote mockup prior to incorporation into the facility design. In addition, remote tooling and equipment shall be maintained as practical, straightforward, and simple as possible. Standardization (sizes, shapes, arrangement) shall also be maintained		
4.2.2.H Special tooling, fixtures, or handling devices required to maintain or replace remote handled equipment will be incorporated into the design.		
4.3.1.F Items such as utility piping, conduits, instrument tubing, and ductwork should be kept to a minimum in potential contamination areas or should be covered to facilitate decontamination.		

REMOTE HANDLED WASTE FACILITY
WVNS VITRIFICATION FACILITY TOUR
OPERATORS FEEDBACK & DESIRES

A walk through tour of the vitrification facility was made to review the facility and to gather feedback from the operators on their concerns with the facility design/construction/operation. The operators expressed their experience on any specific problems encountered. They provided operational and maintenance feedback on what they think should have been done differently "if they knew then what they know now". The purpose of the above was to assess the potential for incorporating there experiences into design and construction to preclude their occurrence on the RHWC facility. Some of the specific operator feedback items are listed below for the Project team's awareness. As a general guidance, the items listed which are also specifically included in the design criteria or included with the RFP conceptual design, and are part of the fixed price provided to WVNS, shall be accommodated. Those items that can be considered and incorporated in the design without impacting the cost of engineering/design/ and construction of this fixed price contract should also be implemented on a case by case basis. Other items not falling into the above categories, which in the opinion of the cognizant engineer are desirable to accommodate shall be brought to the attention of the PM as the design progresses,

OPERATOR FEEDBACK	INFORMATION Supplied by Engineer	DISCIPLINE/ ENGINEER
1. Interference's and interfaces were a general concern including specifically (a) adequate pull space for manipulator arms, (b) access to valves and piping, (c) instrument racks were hard to get to components for maintenance.		
2. Power for lighting should have the capability to remain on when power to motor control centers for equipment is shut off. (shutting off power to equipment for maintenance still requires lighting to see).		
3. Isolation valves need to be planned.		
4. Many pipes and cable trays had several changes of height with no apparent reason (adequate consideration of this item would seem to reduce construction and installation costs).		
5. Floor strength for shield windows weights required special plates for rolling the windows into place (This item needs to be discussed with Butler for tradeoffs of construction costs for larger load bearing weights on floor or the cost of construction inconvenience).		
6. Manipulator maintenance needs to be specifically considered and checklist for maintenance be developed for consideration during design. It was noted that manipulators are a high maintenance item.		

REMOTE HANDLED WASTE FACILITY
WVNS VITRIFICATION FACILITY TOUR
OPERATORS FEEDBACK & DESIRES

OPERATOR FEEDBACK	INFORMATION Supplied by Engineer	DISCIPLINE/ ENGINEER
7. Specific design consideration needs to be done for visibility from windows (e.g., platforms may hide areas below, which the operator needs to see.		
8. Instrument racks were 'too close' to the walls for access for maintenance.		
9. Construction access to vitrification hot cell was significant since there was isolation because of the high radiation levels. Although the Remote Handled Waste Facility will also have high doses; the large access doors should virtually eliminate this concern. It is noted there is also a knockout wall for expansion.		
10. A 2" conduit pipe was used for 1½ electrical cable, which made it very difficult to pull the cables with bends and to not strip the cables.		
11. HVAC building balance was a problem.		
12. Auxiliary cooling for suit-up areas is desired (lower temperature considering the discomfort and productivity associated with these work requirements).		
13. Air dryer was noisy.		
14. View ports for HVAC maintenance are desirable.		
15. PLC standard for projects is desirable.		
15. Breathing air was a problem; need to consider maintenance activities in the design of the system.		
16. Numbering of components should have more logic (e.g., pumps and valves have the same number as the tank with which they are associated).		

WVNSCO RECORD OF REVISION

Rev. No.	Description of Changes	Revision On Page(s)	Dated
0	Original Issue	All	05/07/04
	The original revision of this document and subsequent revisions as received from the Subcontractor are maintained with the original Purchase Order package, PO 19-094708.		